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THE  
Royal Society of Queensland

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Patron :  
HIS EXCELLENCY SIR WILLIAM MACGREGOR.  
M.D., G.C.M.G., C.B., &c.

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OFFICERS, 1913 .

President :  
H. C. RICHARDS, M.Sc.

Vice-President :  
J. SHIRLEY, D. Sc.

Hon. Treasurer :  
J. C. BRUNNICH, F.R.C.

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Hon. Librarian :  
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Hon. Auditor :  
GEO. WATKINS.

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**PROCEEDINGS**  
OF THE  
**Annual Meeting of Members,**  
*Held at University on Wednesday, March 26th, 1913,  
at 8 p.m.*

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The Annual Meeting of the Society was held in the Queensland University, Wednesday, March 26th, 1913, at 8 p.m. The President (P. L. Weston, B.Sc., B.E.) occupied the chair, and there was a good attendance of members.

Apologies from Messrs. W. R. Parker and J. Shirley, D.Sc., were read.

The Minutes of the previous Annual Meeting were read and confirmed.

The Hon. Secretary then read the accompanying Report for 1912, which was adopted on the motion of Mr. E. C. Barton, seconded by Mr. F. Bennett. The Financial Report (as herewith), was moved by Mr. J. C. Brünnich (Hon. Treasurer), seconded by Mr. Weston, and carried.

Mr. J. B. Henderson, F.I.C., urged the necessity of binding much of the Library matter when funds allowed. The Secretary urged that this could not be done till the membership increased, as the expense of publishing valuable papers absorbed practically all the revenue. Mr. E. C. Barton suggested popular science lectures, and personal propaganda as means towards increasing the membership.

TO THE MEMBERS OF THE ROYAL SOCIETY OF QUEENSLAND.

Your Council have pleasure in submitting their Report for the year 1912.

The Ordinary Monthly Meetings have been held as shown in Appendix B.

Eight Council Meetings have been held during the year, at which the attendance was as shown in Appendix A.

During the year 17 members were admitted, and 5 resigned. This shows a satisfactory increase in the membership. We have no deaths to regret.

C. Hedley, Esq., F.L.S., was elected an honorary member. We have now on our Roll 14 honorary members, and ordinary members, 112. See Appendix D.

Special inducements were offered to Science students at the University, but there was not the response expected. This may come after the present year, when the Science students, having finished their University Course, will have time for original research work.

Vol. XXIII. part ii. of our Proceedings was issued during the year, and proved a valuable volume, several of the articles published arousing wide-spread interest and remark. The forthcoming volume is likely to be of considerable scientific value and will give evidence of a valuable year's work.

As foreshadowed in our last Report, considerable expense was entailed in connection with the Library. £4 was spent in shifting it, and £12 in re-arranging, the latter work being yet to be completed. Dr Harvey Johnston took charge in place of Mr. C. T. White, on the removal of the Library to the University. The services of Mr. White in the past are thankfully acknowledged, and the energetic efforts of Dr. Harvey Johnston much appreciated. The systematic acknowledgment of all exchanges received has increased the Librarian's Postage Account. During Dr. Harvey Johnston's absence, Mr. D. C. Gullies is acting as Librarian.

The increase in Library expenses has lowered our Credit Balance despite the increased membership, but this expense will not recur. The forthcoming volume of Proceedings is to be issued without delay, at an earlier date than usual, and it would help the Council to defray its cost if subscriptions were forwarded earlier than usual. The President's Address and the Report will not appear in the volume, as that would delay its issue, but in the next volume.

Our Representatives at the Melbourne Meeting of the Australasian Assn. for the Adv. of Science were Professor Priestley and H. C. Richards, M.Sc.

PERCY L. WESTON, B.Sc., B.E.,  
*President.*

F. BENNETT, *Hon. Secretary*  
3rd. February, 1913.

## APPENDIX A.

## ATTENDANCE OF COUNCIL, 1912.

| Office.               | Name.                              | Council<br>Mt'gs—9 | Sp'ial C'cl<br>Mt'gs—0 | Remarks. |
|-----------------------|------------------------------------|--------------------|------------------------|----------|
| President ..          | P L. Weston, B.Sc., B.E.           | 6                  | ..                     |          |
| Se-President ..       | H. C. Richards, M.Sc. ..           | 7                  | ..                     |          |
| Hon. Treasurer        | J. C. Brunnich, F.I.C. ..          | 5                  | ..                     |          |
| Hon. Secretary ..     | F. Bennett .. ..                   | 9                  | ..                     |          |
| Hon. Librarian        | T. Harvey Johnston,<br>M.A., D.Sc. | 5                  | ..                     |          |
|                       | J. Brownlie Henderson,<br>F.I.C.   | 7                  | ..                     |          |
| Members of<br>Council | J. Shirley, D.Sc... ..             | 5                  | ..                     |          |
|                       | Prof. Priestley .. ..              | 1                  | ..                     |          |
|                       | E. H. Gurney .. ..                 | 7                  | ..                     |          |
|                       | J. F. Bailey .. ..                 | 2                  | ..                     |          |

## APPENDIX B.

## LIST OF PAPERS, ETC., READ DURING 1912.

| P | Date.   | Title.   | Author.  |
|---|---------|--|--|
|   | 1912.   |  |  |
| 1 | Mar 25  | National Waste (Presidential Address)  | J. Brownlie Henderson, F.I.C.  |
| 2 | Apl 24  | 1 An Extinct Crater near Herberton<br>2 Critical Census of Australian Mallophaga .. ..<br>3 List of Mallophaga found on Native and Introduced Animals in Australia .. .. | R. C. Ringrose, M.A.<br>T. Harvey Johnston, M.A., D.Sc., and L. Harrison.                          |
| 3 | May 29  | 1 Revision of Queensland Lichens<br>2 Exhibit—New Mineral from North Queensland .. ..<br>3 Exhibit—Entozoa .. ..   | J. Shirley, D.Sc.<br>F. E. Connah, F.I.C.<br>T. Harvey Johnston, M.A., D.Sc.                       |
| 4 | June 26 | 1 Entozoa .. ..<br>2 Freshwater Fish of Queensland ..<br>3 Ceratodus .. ..   | T. Harvey Johnston, M.A., D.Sc.<br>Allan McCulloch.<br>D. O'Connor                                 |
| 5 | July 31 | 1 Queensiand Shells.. ..<br>2 Exhibit—A Poisonous Pycnodon<br>3 The Freezing Point of Milk ...   | J. Shirley, D.Sc.<br>O. Weston & J. Brownlie Henderson, F.I.C.                                     |
| 6 | Oct 2   | The Burdekin Valley and Certain Physiographic Theories.. ..  | E. O. Marks, B.A., B.E.  |
| 7 | Nov. 27 | 1 A Beetle that takes in Ballast ..<br>2 Notes on the Westralian Lepidoptera (Pyrilidæ) .. ..<br>3 Census of Australian Pediculids..                                     | F. P. Dodd.<br>A. Jeffries Turner, M.D., F.E.S.<br>T. Harvey Johnston, M.A., D.Sc. and L. Harrison |

**THE ROYAL SOCIETY OF QUEENSLAND.**

## FINANCIAL STATEMENT for the Year 1912

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|                                | RECEIPTS.         |  | DISBURSEMENTS.     |
|--------------------------------|-------------------|--|--------------------|
| To Balance from last Report .. | £ s. d.<br>55 4 7 | By Printing (Pole and Co.) ..                                  | £ s. d.<br>69 15 6 |
| " Subscriptions ..             | .. ..<br>85 11 6  | " Postage of Monthly Notices ..                                | 4 1 2              |
| " Sale of Proceedings ..       | .. ..<br>4 1 6    | " Postage of Proceedings, also Librarian's Postage Expenses .. | 5 12 6             |
| " Secretary ..                 | .. ..<br>0 12 0   | " Insurance ..   | 1 2 6              |
|                                |                   | " General Postage and Petty Cash..                             | 6 2 4              |
|                                |                   | " Caretaker ..   | 1 0 0              |
|                                |                   | " Cartage of Library ..  | 4 0 0              |
|                                |                   | " Re-arranging Library ..                                      | 12 3 5             |
|                                |                   | " Printing for Aust'n. Assoc'n for the A. of Sc. ..            | 0 16 6             |
|                                |                   | " Letter Box ..  | 0 5 0              |
|                                |                   | " Bank Charges ..  | 0 10 0             |
|                                |                   | Balance ..   | 40 0 8             |
|                                |                   |  | <hr/> <hr/>        |
|                                |                   |  | £145 9 7           |

**Examined and found correct.**

GEO. WATKINS, Hon. Auditor.

*Brisbane, 13th March, 1913.*

**J. C. BRÜNNICH, F.I.C., Hon. Treasurer.**

## APPENDIX D.

## LIST OF MEMBERS.

(1912.)

## HONORARY AND CORRESPONDING MEMBERS (14.)

Dr. Cockle; A. Liversidge, F.R.S., F.C.S., F.G.S.; Rev. F.R. M. Wilson J. H. Maiden, F.L.S.; H. J. Jensen, D.Sc.; Rev. G. Brown, D.D.; A. Gibb-Maitland, Government Geologist, W.A.; Professor E. W. Skeats; Professor E. H. Rennie; Professor J. A. Pollock; Dr. K. Domin. (Czech University), Prague; Dr. Danes (Czech University), Prague; Professor T. Edgeworth David, C. Hedley, F.L.S.

## ORDINARY MEMBERS (112); LIFE MEMBERS (14)

Archer, R. S.  
 Badger, J. S.  
 Ball, L.C., B.E.  
 \*†Bailey, F. M., F.L.S., C.M.G.  
 †Bailey, J. F.  
 Barton, E. C., A.M.I.C.E.  
 Bell, D. J.  
 Bennett, F.  
 Brunnich, J. C., F.I.C.  
 Brydon, Mrs.  
 Bundock, Miss Alice  
 Bundock, C. W., B.A.  
 Byram, W. J.  
 †Cameron, John  
 Cameron, W. E., B.A.  
 Colledge, W. R.  
 Collins, Miss Jane  
 Collins, R. M.  
 Connah, F. E., F.I.C.  
 Cooper, Sir. Pope A., C.J.  
 Costin, C. W.  
 Cowley, R. C.  
 Dempsey, J. J.  
 Denham, H. G., M.A., D.Sc., Ph.D.  
 Dunstan, Benj.  
 Eglinton, Dudley, F.R.A.S.  
 Eglinton, Miss Hilda  
 Elkington, J. S. C., M.D., D.P.H.  
 Fewings, P. P.  
 Forrest, Hon. E. B.  
 Fraser, C. S.  
 †Gailey, Richard  
 Gibson, Hon. Angus, M.L.C.  
 Gore Jones, E. R.  
 Greenfield, A. P.  
 \*†Griffith, Sir S. W.  
 Gurney, E. H.  
 Halstead, W. H.  
 Hamlyn-Harris, R., D.Sc.,  
 F.R.M.S., F.L.S., F.E.S.  
 Harvey-Johnston, T., M.A., D.Sc.  
 Henderson, J. Brownlie, F.I.C.  
 Hirschfeld, Eugen, M.D.  
 Holland C. W.  
 Hopkins, G., M.D.

Hulsen, R.  
 Hunt, G. W.  
 Illidge, Rowland  
 †Jack, R. L., L.L.D., F.G.S.,  
 F.R.G.S.  
 Jackson, A. G.  
 Johnston, Jas.  
 Kenny, F. Hamilton, M.D.  
 Lambert, C. A.  
 Lennon, R. T.  
 Lindsay, W.  
 Longman, H. A.  
 Lord, F.  
 Love, Wilton, M.B.  
 Lucas, T. P., L.R.C.P.  
 Lusby, S. G., M.A.  
 Lyons, R. J., B.A.  
 His Excellency Sir William  
 MacGregor, M.D., D.Sc.,  
 G.C.M.G. C.B., &c.  
 Marks, Hon. C. F., M.D., M.L.C.  
 Marks, E. O., B.A., B.E.  
 May, H. W., B.E.  
 May, T. H., M.D.  
 Michie, J. L., M.A.  
 Murray-Prior, Mrs.  
 McCall, T., F.I.C.  
 McConnel, E. J.  
 McConnell, Eric W.  
 McConnell, J. H.  
 Morris, Leon, A.M.I.C.E., Eng.  
 Morton, C. R.  
 †Norton, Hon. A., M.L.C.  
 Oakes, A. W., B.A.  
 Papi, F. C., Ph. D.  
 Parker, T., F.G.S.  
 Parker, W. R.  
 Parnell, T., M.A.  
 Plant, Hon. E. H. T., M.L.C.  
 Pound, C. J., F.R.M.S.  
 Priestley, H. J., M.A.  
 \*Raff, Hon. Alex, M.L.C.  
 Rands, W. H., F.G.S.  
 Reid, D. E.  
 Richards, H. C., M.Sc.

*List of Members—(Continued)*

|                             |                                   |
|-----------------------------|-----------------------------------|
| Riddell, R. M.              | †Stevens, Hon. E. J., M.L.C.      |
| †Roe, R. H., M.A.           | Sutton, A., M.D.                  |
| Ryan, J. P., M.D.           | †Sutton, J. W.                    |
| Sankey, J. R.               | Swanwick, K. ff., B.A., LL.B.     |
| Saunders, G. I., B.E.       | Taylor, Hon. W. F., M.D., M.L.C.  |
| Schild, S. D., A.S.A.S.M.   | Thynne, Hon. A. J. M.L.C.         |
| (Adelaide)                  | Turner, A. Jefferis, M.D., F.E.S. |
| †Schneider, H., M.A.        | Watkins, Geo.                     |
| Shirley, John, D.Sc.        | †Weedon, Warren                   |
| Smith, F., B.Sc., A.I.C.    | Weston, P. L., B.Sc., B.E.        |
| Spark, E. J., M.D.          | White, C. T.                      |
| Spenceley, T.               | White, Jean, D.Sc.                |
| †Steele, T., F.L.S., F.E.S. | Willcocks, G. C.                  |
| Steele, B. D., D.Sc.        |                                   |

## ASSOCIATE MEMBER.

Gillies, D. C.

Miss Freda Bage, M.Sc., and A. B. Walkon were proposed as new members, by Messrs. Henderson and Richards, respectively. Mr. J. W. Watkins, proposed by J. Shirley, D.Sc., was unanimously admitted as a member.

The President then delivered his retiring address.

### THE INTERNAL COMBUSTION ENGINE AS A FACTOR IN NATIONAL PROGRESS.

The subject which I have chosen for my address is perhaps of too technical a nature to prove of general interest on such an occasion, but, as it rarely falls to the lot of an engineer to have the honour of presiding over this society, the choice of an engineering subject might be excused just for once. In vain did I search for some subject of a more suitable and catholic a nature, such as the question of national waste which produced such an interesting and instructive address from our preceding president, Mr. Henderson. My subject to-night is in one particular direction a sequel to Mr. Henderson's address, inasmuch as it deals with means for minimising the national waste in one important direction—viz., fuel consumption.

My theme deals with the influence of the internal combustion engine on national progress and development. It is perhaps hardly necessary to point out that

the onward march of civilisation is marked by an ever insistent demand for power. The immense progress of the past century is largely to be attributed to the development of the steam engine, which has reigned supreme as a prime mover or machine for the production of mechanical power since the days of Watt. There are many signs, however, that this supremacy is being seriously challenged by the internal combustion engine, mainly by reason of its superior efficiency as a heat engine or apparatus for turning the energy of fuel into mechanical power. We know from a study of the theory of heat engines that of the total energy to be derived from the combustion of fuel not more than about 15 per cent. can be converted into mechanical work by the combination of a steam boiler and steam engine or turbine, whereas with an internal combustion engine as much as 35 per cent. of the fuel energy can be converted into useful work. Hence it is safe to assume that the promise of the future lies with the engine having the higher intrinsic efficiency, and in the same way as the 19th century can be aptly called the steam age so the 20th century seems destined to merit the designation of the gas age. The term gas engine can for the sake of brevity be used to include all forms of internal combustion engines.

Except in a few favoured localities where water power is available power has to be mainly derived from the combustion of fuel of various kinds, of which coal is the chief. Consequently one of the most important of a nation's assets lies in its stores of fuel and the rate of consumption is so rapid that the question of the conservation of fuel resources is one of ever increasing urgency. From time to time we have pointed out the inevitability of the early depletion of our coal and other natural fuels, especially of the higher grades, but unfortunately too little heed is paid to this matter of vital national importance. Fortunately much of the present waste of fuel can be minimised by the adoption of the internal combustion engine, with its superior economy and adaptability to use low grade fuels, which are at present discarded. The economic import-

ance of doing this can hardly be over-estimated. Owing to a number of varying factors this problem presents itself in a different aspect in every country.

In Australia, with its limited population and manufacturing industries, together with a fairly plentiful supply of coal, the necessity for economising fuel has not been so pronounced as in most other older countries. Consequently we are far behind these places in the use of the gas engine. I fancy we hardly realise the extent of the development that has taken place on the Continent in this direction. In order that success can be achieved with gas engines of any considerable size the local conditions have to be carefully taken into account, more especially with regard to the nature of the available fuel. Very little has so far been done in Australia in this direction, and there is scope for much investigation of local coals, etc. Other countries, notably Germany, under stress of dear fuel conditions, have successfully utilised fuels which previously were of no commercial value. For instance, gas engines are being successfully operated on mine refuse containing as high as 80 per cent. of non-combustible matter, and peat and lignite containing 50 per cent. of water.

Such fuels are absolutely useless for steam-raising purposes. The waste gases from coke ovens, blast furnaces, and even copper smelters are also very extensively used for operating gas engines. We have had pointed out to us the possibility of more economically using Ipswich coal for various power requirements in Brisbane by generating electricity at the pit's mouth from inferior fuel instead of transporting higher grade coal to the metropolis. Of the economy and feasibility of such a scheme there can be little doubt in the technical mind, but before such a project can eventuate it is generally necessary for the public to appreciate the value of the proposal. In the case of water power, the man in the street rarely fails to discern the potentialities of a handy waterfall, and hence it is usually comparatively easy to get such a scheme developed. For instance, if we had a Barron Falls at Ipswich it would no doubt have been harnessed for Brisbane's needs long ago. It may occa-

sion surprise to many to learn that even in our present state of knowledge power could probably be produced by gas engines at Ipswich at a price which would compare with the cost of the average water power scheme with its expensive hydraulic engineering works. Water power is comparatively scarce in Australia, and for that reason our engineers should be fully alive to the possibilities of the gas engine as a source of cheap power.

In this respect I may mention that the manufacture of calcium carbide, which is usually considered to be commercially possible only when cheap water power is available, is now being successfully carried on in New South Wales with gas engines using coke as fuel. There seems to be every probability of metallurgical coke being produced at Ipswich in large quantities in the near future, and the generation of power from the oven gases would appear to be a natural sequel. When one looks into the commercial use of gas and other internal combustion engines the most noticeable feature is the relative scarcity of engines of large or even moderate size. The cause of this is that all internal combustion engines show up to best advantage when in comparatively small units, say, below 200 horse power. Larger units show no increase, either in fuel consumption or first cost per brake horse power, while increase of size is accompanied by greatly increased difficulty of construction and operation.

This is in marked contrast to the steam engine, and more especially the steam turbine, as, in both these types of prime movers increase of size is accompanied by decrease of fuel consumption and capital cost per horsepower, while difficulties of construction and operation do not materially increase. As a result gas engines over about 200 horse-power capacity are almost as rare as steam turbines under this capacity. These intrinsic differences between gas and steam engines are due solely to the higher temperature of the working fluid in the gas engine. In the steam plant the fuel is burnt in the boiler furnaces at a temperature of, say, 1200 degrees Centigrade, and the heat transmitted to the working fluid, steam, which enters the engine at, say, 200 degrees Centigrade.

In the internal combustion engine the working fluid is air, which is heated by the direct combustion of the fuel inside the cylinder to as high as 1700 degrees or 1800 degrees Centigrade. Since the working parts could not, for obvious reasons, be allowed to attain this temperature, the positive cooling of the cylinder walls is a practical necessity. In the steam engine the temperatures are easily dealt with, and the abstraction of heat from the cylinder walls is to be avoided as being merely a source of waste.

Since increase of cylinder dimensions means a decrease in the ratio of area of cylinder walls to cylinder volume, it will be seen that, whereas this condition is desirable in a steam engine, in a gas engine it merely leads to practical difficulties in keeping the temperature of the working parts within a practical limit. For instance, when the diameter of a gas engine cylinder is greater than about 20in. it becomes necessary to water cool the moving piston, whereas in smaller sizes water jacketting of the cylinder walls is quite sufficient. In large cylinders also the increased thickness of metal required to resist the explosion pressure leads to liability to severe internal strains, due to unequal expansion of the metal, and pistons and cylinders have frequently cracked from this cause. In addition to the above troubles with large gas engines, the fuel used in the majority of the larger size units was either coke oven gas or blast furnace gas, and it was not properly realised that efficient purification of such gas was necessary to avoid fouling of the engine.

The result has been that the large gas engine has in the past gained an unenviable reputation for unreliability of operation. Profiting, however, from past experiences, designers have now been able to produce large gas engines for various classes of land service which approach very closely the reliability of operation of good steam engines. It must not be supposed, however, that the one class of engine will satisfy all classes of service. Many of the failures to secure satisfactory service have been due to the attempt to apply the one class of engine to all classes of work. Now, in steam engine practice, very

widely differing types of engine have been evolved for different kinds of work and the same process of evolution is now taking place, and already many standard designs have been produced. The largest engines at work are those to be found in most modern iron smelting works in America and on the Continent. In the largest of these installations the power of the engines aggregates 150,000 horse power. The economy of using the gases escaping from the blast furnaces has in many cases reduced the cost of the production of pig-iron by 2 or 3 per cent.

The efforts of designers are now being mainly concentrated on the problem of adapting the internal combustion engine in large sizes to marine work. This is a matter which I think is worthy of special comment on this occasion, because probably the most noteworthy engineering achievement of the term of my presidency has been the birth of the motor ship. The pioneer ship of any considerable size to be fitted with internal combustion engines was the *Zealandia*, launched early in 1912, and during the same year no less than nine other ocean-going ships were launched. It is perhaps a matter for national regret that, though the British engineer led the way in the development of the marine steam engine, and later on the marine steam turbine, yet in the matter of the marine internal combustion engine the pioneers have been chiefly Swedish, German, and other continental engineers. There is, however, every indication that the English engineer and shipowner will before very long make up the leeway, and it is pretty safe to prophesy that before long the public will have to get reconciled to the disappearance of the familiar funnel from the ocean tramp and other low powered craft. Whether it will be feasible to produce internal combustion engines of suitable size for the high powered liner and battleship is a matter about which it would now be premature to express an opinion. It must be remembered that the working fluid in an internal combustion engine is actually white hot flame, and when one considers the amount of heat being produced in the numerous furnaces of a big liner and realises that to produce the same power in an

internal combustion engine approximately half as much heat has to be generated as white hot flame inside the cylinders themselves, the problem of doing so is seen to be of no mean order.

At present the marine engine is invariably of the Diesel oil engine type, and so far satisfactory operation has been secured in sizes up to 200 to 300 horse power per cylinder. As the Diesel engine is unique among internal combustion engines, and has only recently become prominently under the notice of the lay public, a brief description of its peculiar features may not be out of place. In other forms of internal combustion engines, the fuel which may be combustible gas or oil in a state of vapour or minutely subdivided is drawn into the cylinder together with the air necessary for combustion. This charge of explosive mixture is then compressed by the return stroke of the piston and caused to ignite at the proper instant by electric spark or other suitable means.

In the Diesel engine, however, the fuel charge is not admitted to the cylinder until the end of the compression of the cylinder charge. The compression of any gas is accompanied by rise of temperature, and in the case of the Diesel engine the compression is carried to such a degree that the air in the cylinder is red hot before the oil fuel is injected into it. In this way ignition and perfect combustion are secured without any separate ignition device. Incidentally a higher degree of economy in fuel consumption is secured by the high compression pressure than is possible in other forms of internal combustion engines and, more important still, cheap crude oils and even tar oils can be readily used. The consumption of oil per brake horse power is less than half a pound per hour as compared with, say, three times this weight of coal which the steam engine requires for the same output. The gain in saving of cargo space by the adoption of the Diesel engine is then obvious and also the desirability of eliminating the steam boiler and the stokers to feed it.

There are other advantages, such as the ease of handling liquid fuel and the instant readiness for starting of the Diesel, as compared with the time required to get up steam in a boiler. It seems improbable that the steam turbine will be superseded by the internal combustion engine for some time to come where very large powers are concerned, but the present limits are bound to be exceeded, and the present rate of the development of the latter engine is surprisingly rapid. Perhaps here in Australia we can hardly realise the progress being made on the other side of the world in this direction, and especially on the Continent. It is a remarkable fact that in Germany the manufacture of steam engines has almost been abandoned, and the works are turning out instead gas and Diesel engines, the latter mostly adapted to operate on tar oil. There are approximately 30 German firms manufacturing Diesel engines, while Britain has only three makers.

Much work remains to be done in connection with investigating the best means of utilising various classes of fuel in internal combustion engines. In Germany a State commission has been constituted to deal with this problem. This is an example which might well be followed in every country, since each locality has its own particular kinds of fuel. Ordinary bituminous coal can be prepared for use in internal combustion engines in several ways. It can be gasified in various forms of producers, which turns both the fixed carbon and the volatile constituents into fixed gases, or other forms of producers may be used, which leave the tarry vapours to be condensed into creosote, benzol and other distillate oils. The benzol will no doubt very largely replace petrol for motor car engines and similar purposes, while the heavier oils can be used in Diesel engines. It is obvious that liquid fuel can be transported with much greater ease than coal, so that the tendency of the future will be to abandon the present wasteful method of mining only the choicest portions of the coal seams and transporting the solid fuel over long distances. Instead, the whole of the seam will be utilised for the production of power at the pit's mouth, and for the various liquid fuels and

other by-products. Already the available supplies of petroleum oils are unable to cope with the demand, and prices are on the increase, so that sooner or later other sources of oil must be pressed into the service.

Turning now to a consideration of the more common applications of the internal combustion engine, we find that for small powers it stands practically unchallenged as a prime mover. For ordinary industrial work up to, say, 200 horse power gas engines with suction gas producers using anthracite, coke, or charcoal, have become extremely popular, and form very convenient and economical sources of power. It is not, however, yet fully recognised by the public that such plants have certain peculiar limitations with regard to overload capacity and behaviour when running on varying loads.

There is also a more or less popular impression that these plants can be successfully run by unskilled attendance. As with other classes of comparatively high grade machinery proper reliability of service can only be ensured by having suitably trained attendants. In Australia at any rate the supply of really capable gas engine attendants is somewhat limited, with the result that complaints of unreliability are not common, especially with units of any size. While the cause of trouble is very often due to unskilful engineering in selecting the plant, or in the manner of erection, or even in the design or manufacture of the plant, still, with a properly trained man in charge, reliable operation can generally be obtained such as would compare favourably with steam plant.

It is to be hoped that the facilities now being offered by technical education will be effective in remedying the deficiency in the near future. In this connection, I may remark in passing that some four years ago I had the privilege of inaugurating what I believe was the first course of technical classes in Brisbane dealing with the internal combustion engine. The present trend of practice is towards the use of cheaper fuels, such as bitu-

minous coal, wood, etc., which have been previously found difficult to gasify in the ordinary form of updraught producer without including tarry vapours which affect the running of the engine.

A number of different types of producer have been designed to obviate this difficulty, and it is perhaps worthy of special mention, that one of the most promising designs originated in New Zealand, and is coming into local use. This development, if it proves as successful as present indications promise, will still further popularise the suction gas plant, especially in fairly moderate sizes where the cost of fuel begins to be a considerable item. The influence of such a cheap and convenient source of power for comparatively small installations is no mean factor in the development of every country, and more especially in a comparatively young and sparsely populated country like Australia. The small manufacturing concern, the butter factory, the irrigation plant of the farmer, the isolated electric light installation are familiar instances of its ready application. In many other countries the Diesel oil engine is a close competitor of the suction gas plant for such work, but locally the comparatively high cost of oil, and the uncertainty of supply, have put it at a disadvantage. It is in the sphere of portable work of all kinds, however, that the internal combustion engine has made its influence most felt. It is almost unnecessary to mention its use for motor car, motor boat, and aeroplane work. So great has been the demand for engines for these purposes that already a very high degree of excellence has been attained in the design and manufacture of petrol engines of these types.

A critical examination of, say, a modern aeroplane or high-class automobile engine discloses a truly courageous piece of machinery, which for lightness of construction in relation to output would have been considered mechanically impossible a few years ago. The demand for materials of the highest possible strength has led the metallurgist to produce various alloys of iron and other metals, usually termed alloy steel, which possess extraordinary strength and toughness. For in-

stance, we have nickel steel, with an elastic limit of 70 tons per square inch, chrome vandum spring steel which will permit twice the working extension in a spring that can be endured by an ordinary carbon steel spring, and a host of other alloy steels with peculiar properties for the particular service for which they were produced. In addition, machinery has been perfected for obtaining extreme accuracy of workmanship in machining parts of engines and motor cars in general. For instance, hardened steel balls for ball bearings are guaranteed to be accurate in diameter to within one-ten-thousandth (.0001in.) of an inch. In fact, not only do we owe to the internal combustion engine the whole of the motor car industry, but mechanical engineering generally has advanced in innumerable ways in response to the demands of the motorist. The mechanical achievement represented in, say, a modern racing car, is to say the least of it, rather surprising. We take a flimsy-looking engine, mount it on a springy platform, make it develop very considerable power by getting, say, twenty explosions per second behind a piston, which is subjected to, say, a thrust of two tons each time, and let the whole power station on wheels fly along at speeds of approaching 100 miles per hour, or higher than the fastest steam locomotive. Of the value of motor transport little need be said, as we see its use extending every day, and we have now the motor car, motor lorry, fire engine, tractor, railway autocar, motor cycle, and a host of other possible applications of the ever-ready little engine.

Australia with its immense distances affords a wide field of usefulness for all kinds of motor transport. Few station homesteads are without their motor cars, and the motor tractor is beginning to be widely adopted, especially in dry country, where the steam traction engine is at a disadvantage. For railway work it appears most probable that certain classes of traffic can be better handled by the railway autocar than by the steam locomotive, and experiments in this direction are shortly to be made on the Queensland railways. Where the traffic does not warrant the use of long trains, a single motor coach can be used to advantage, the cost of working being less.

owing to the abolition of the stoker, and the engine is always ready for starting without the necessity for incurring stand-by losses as with a steam locomotive. There is also the absence of grit or sparks, and the problem of taking in fuel and water is much simplified. I understand the use of internal combustion engines is suggested on the transcontinental railway, owing to the scarcity of water along certain sections of the route. Though I understand the autocars now being procured by the Railway Department were intended for trial in country districts where traffic is infrequent, this system seems to me to be very promising for suburban traffic in order that a quick service could be maintained. The Enoggera line, for instance, would benefit greatly by a more frequent service than is warranted at present with the ordinary steam train. The high cost of oil fuel in Australia is, however, a serious drawback. One respect in which the internal combustion engine is inferior to the steam engine is in the ease with which the latter can be started and stopped. This necessitates the use of special means of transmitting the power from the engine to the wheels, a frequent method being to do this electrically, an arrangement which gives great flexibility of control, which is of special value for high speed work with frequent stops. For work of all kinds where small power is required, engines using petrol and paraffin practically hold the field except, of course, where electric supply is available.

In these days of high wages every effort should be made to supplant manual labour by power as far as practicable, and new uses for the internal combustion engine are being found every day. In building operations, for instance, hoisting of materials, mixing up of concrete, sawing and dressing of timber, and stone dressing tools should be power driven whenever there is any quantity of such work to be done.

One future sphere of usefulness for small engines is for producing electric light in small isolated installations such as a country hotel or station homestead. The remarkably high efficiency of the modern metal filament

lamp has enabled such an arrangement using storage batteries to commercially compete with acetylene and other forms of lighting and when this is realised by the public small electric lighting schemes will become very popular. While on this subject I may be permitted to remark that in the matter of electric lighting in this State we are decidedly behind the times in many respects.

A prominent visitor recently remarked to me on the public lighting of the Brisbane streets, or rather on the comparative absence of such in the main streets, and on taking a house in New Farm expressed surprise that electric supply was not available in the suburbs. In the question of electric supply our provincial towns are very much behind those of the other Australian States, where small electric supply schemes are being installed in large numbers, the source of power being in most cases suction gas plants. Why Queensland should be so less progressive in these respects than the Southern States I fail to understand, more especially as the climatic conditions render electric lighting and fans highly desirable.

However, it is gratifying to note signs of a spirit of inquiry and progress in our citizens as evinced, for instance, in matters of education and sanitation, and I hope that now the spirit of unrest, which spells the dawn of progress has been engendered further advancement will not be long delayed. We may even hope for the adoption of a decimal system of weights, measures, and even money, for the establishment of a rational system of training our artisans now that the old apprenticeship system is dead, for direct railway connection across the river and the proposed standard gauge line along the coast to New South Wales, for a new town hall, for revision of the Electric Light Act and the Local Authorities Act in so far as it debars local authorities from establishing electric supply schemes, and we may even hope to secure proper public recognition of the value and the status of the engineer.

Returning now to our original theme, and summing up, the internal combustion engine has already become a factor of great economic importance in our national life, and before long it promises to become the chief agency for turning the useful energy of fuel to account unless the dream of the scientist of turning the energy of fuel direct into electricity without first producing mechanical work is realised.

With regard to general design of internal combustion engines, the present standard design of reciprocating engine is not likely to be drastically altered unless the present fundamental principles of operation are abandoned, since its performance very closely approaches in efficiency what is theoretically possible under the circumstances. The possibility of the evolution of a gas turbine is often mentioned, but when the problem is carefully examined it does not look very promising. There is, however, a special form of engine for pumping purposes which is most interesting, and bears little resemblance to the ordinary form of engine. This is the Humphrey gas pump, in which there is no piston in the ordinary sense of the word, its place being taken by the fluid to be pumped, which is subjected directly to the force of the explosion in a closed chamber. In this way there is a practical elimination of working parts, and as the apparatus takes the place of both an engine and a pump, a very high efficiency is possible, and these plants have been successfully used for very large installations.

In conclusion, I may remark that fire has been the servant of man since the dim days of our prehistoric ancestors, and its uses have been multiplied through the ages, contributing in no small degree to the advancement of civilisation. A new era was heralded when mankind learned how to harness steam, the product of the two opposing elements, fire and water, and extract its latent energy by the steam engine. Now another era has been instituted by the subjection of our willing slave in a more direct manner in the internal combustion engine.

In the one case we imprison him within the walls of a furnace made of refractory materials, but now we have

bottled him up inside the metal walls of the engine itself, like one of the genii of mythical fancy pent up in a magic jar, and ever struggling to escape from his prison.

With the aid of our tame giant we are enabled to outstrip the fastest steed on land, the fish in the sea, and the bird in the clouds, so there are no more kingdoms for us to invade and conquer. How much further progress will be made it is impossible to predict, except to venture the opinion that, while steam still holds the field in most cases where large powers are required, this supremacy will shortly be seriously challenged by its more modern rival. In this development the services of the engineer will be largely dependent on the researches of the chemist into matters pertaining to the treatment of fuels, and on the metallurgist for the production of special alloys and other materials to resist the onerous conditions of service.

Mr. Henderson moved a vote of thanks to the President for his interesting and valuable address.

The following office-bearers were declared elected unopposed for 1913 :—

President—H. C. Richards, M.Sc.

Vice-President—J. Shirley, D.Sc.

Hon. Treasurer—J. C. Brännich, F.I.C.

Hon. Secretary—F. Bennett.

Hon. Librarian—T. Harvey Johnston, D.Sc.

Assistant Hon. Librarian—D. C. Gillies.

A ballot among J. F. Bailey, E. C. Barton, A.M.I.C.E., E. H. Gurney, Professor Priestley, P. L. Weston, B.Sc., B.E., R. Hamlyn-Harris, D.Sc., resulted in the election of the five former as Councillors.

Mr. G. Watkins was re-elected Hon. Auditor.

The new President was then inducted to the chair, and returned thanks for his election.

The Report from the Delegates to the Melbourne Meeting of the Australasian Association for the Advancement of Science was read.

On the motion of Mr. Barton, the President and Mr. Weston were deputed to meet the Decimal Association's representatives on April 1st, 1913, and the meeting terminated.

## ON AN EASY AND CERTAIN METHOD OF HATCHING CERATODUS OVA.

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**By THOS. L. BANCROFT., M.B. Edin.**

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*Read before the Royal Society of Queensland, April 29, 1913.*

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Hitherto only a very few of the *Ceratodus* ova obtained each season hatched out\* and it was generally considered by myself and others, who have made the attempt, that the ova were easily injured by handling or that strong light quickly killed them or that a large proportion were infertile, that it was essential for success to keep them in running water or the water changed for fresh every day.

Semon in his work "In the Australian Bush," p. 90, says:—"The eggs of *Ceratodus* are extremely frail and tender. If the water in which I kept them for breeding purposes became too warm or there happened to be too many in one vessel or if I did not take care to remove every dead egg immediately, all the eggs died off rapidly. This circumstance formed a great hindrance to my embryological collecting."

Having made the discovery that when more than three ova were placed in the same glass jar all of them perished, and that with two or three ova success occasionally followed; it occurred to me that if each egg could be kept separately in a jar of water of its own, any that were then alive would probably develop. For this purpose I gathered together over a hundred pickle bottles, filled them with river water and placed each bottle inside a jam tin to exclude light, old rusty tins from the rubbish heap were requisitioned; the tins with their bottles were placed on and under a table in a corner of the verandah and screened from the light

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\* Proc. Roy. Soc. Queensland Vol. xxiii., p 251.

with a few corn sacks. Into each bottle one egg was dropped. Upon examination of the ova in a week's time almost every one was noticed to be alive ; this is easily seen by observing the change in shape of the yolk from the round to pear shape (see figure, b and c). In three weeks' time the little fish had left their gelatinous envelopes. A bit of conferva was then dropped into each bottle for food ; shortly afterwards the little fish were noticed to have insinuated themselves in the conferva and even when the latter had floated to the top, as occasionally occurred, the fish were able to find it. The bottles were disturbed as little as possible and the water was not changed nor added to, and at the end of four weeks, although the water had diminished by evaporation to less than half, it made no difference whatever.

The little fish after a week's sojourn in the pickle bottles were removed to glass cells of a half to a gallon of water capacity, prepared with some clay at the bottom and conferva ; ten fish were put into each vessel. Some of the jars were placed in a tub of water so as to keep them cool. Some were left on the table and in these the fish thrived equally well, but a time came when the whole lot suddenly died one day, and it was thought from the water getting too warm. Some fish were put into a wooden tub, it was half a wine cask ; I had used it before as an aquarium ; it was cleaned out and filled with river water and some conferva and pieces of floating green water weed put in ; no clay or sand ; it was so arranged that any insect enemies might be easily detected ; it was partly covered over with a board to exclude light. The tub was placed inside a galvanised iron wash tub containing water, the idea being to prevent evaporation from the wood.

The fish for the most part lie quietly at the bottom ; they never bury themselves in the clay and never come to the top to breathe air. At night time they are more active ; in one glass jar, which was totally immersed in a tub of water, the little fish escaped into the tub during the night.

No attempt was made to feed the fish otherwise than with conferva. There is evidently some other food neces-

sary for their well-being, and possibly they need cooler and deeper water than I was able to give them.

The fish, whether in glass cells or in the tub, rapidly increased in size to three-quarters of an inch in length and up to two months ; after that time they were noticed to become sluggish and emaciated and began to die off, and at the end of three months all had died.

I am of opinion that were the *Ceratodus* reared even up to two months and then liberated in a suitable artificial lagoon, that a large number would survive.



A—Appearance of fresh egg, life size.

B—End of one week.

C—End of second week.

D—Empty envelope showing exit hole.

E—Young *Ceratodus* just emerged ; will often go back into gelatinous envelope if disturbed.

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# THE GEOGRAPHICAL DISTRIBUTION OF QUEENSLAND GASTEROPODA.

By **JOHN SHIRLEY, D.Sc., F.M.S.**

(SENIOR INSPECTOR OF SCHOOLS.)

*Read before the Royal Society of Queensland, June 27th, 1913*

The number of aquatic gasteropods, reported as inhabiting Queensland waters, amounts in all to 1,619 species. Mr. Charles Hedley published a list\* and supplement† of 1328 species; and, in papers read before this Society, the writer has supplied lists containing 291 additional names.

A study of the geographical distribution of these 1619 gasteropods has revealed some interesting facts. One of the most striking is the similarity of the molluscan faunas of the Indian and Pacific Oceans; no less than 520 Queensland species, or nearly one-third of the whole, having this extremely wide range. It, therefore, seems likely that the two oceans have been in free and uninterrupted connection for many geological ages, since many species, which are at home in both oceans, belong to such genera as *Turbo*,‡ *Trochus*‡ and *Phasianella*, known to extend back to Devonian times; others as *Haliotis*, *Nerita*, *Litorina*, *Strombus*, *Triton*, (Cymatium), *Dolium* (Tonna), *Sigaretus*, *Mitra*, *Cancellaria* and *Murex*° to Cretaceous times; while *Liotia*, *Terebellum*, *Ranella*, (Bursa), *Marginella*, *Engina* and *Purpura* date from the Eocene epoch. Very few genera, belonging to the two oceans in common, appeared later than the Miocene era.

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\*Proc. Aust. Assoc., Vol. XII., pp. 343-371.

†Loc. cit., pp. 809-810.

‡Tryon, Vol. I., p. 57, says "Silurian."

°Tryon, Vol. I., p. 57, says "Jurassic."

Just as the most westerly region in which the Malay race exists is the island of Madagascar, so this Indo-Pacific molluscan region, with its centre of distribution in Malaysia, has for its western frontier the eastern coast of Africa, 76 species found on the northern or eastern coasts of Queensland being reported from such distant localities as Natal, Madagascar, Mozambique and Zanzibar. A common shell of our Barrier Reef—*Septa aquatilis*, Reeve, better known as *Triton plearis*, L., is reported from the following localities:—Natal, Seychelles, Red Sea, China, Japan, Philippines, Australia, the Sandwich Islands, and, still stranger from Florida and Brazil. The genera best represented and most widely spread are *Cerithium*, *Strombus*, *Conus*, *Ovula* and *Purpura* (Thais).

This great province, formed of the two oceans that have no north and south barriers, and in which therefore the great equatorial current is not deflected into frigid regions, extends also into the Red Sea, where 147 species are common to that sea and to the shores of Queensland. The genera best represented are:—*Cerithium*, *Strombus*, *Triton* (*Cymatium*), *Ranella* (*Bursa*), *Conus*, *Pyramidella*, *Drillia* and *Mitra*. So strong is the relationship between the Red Sea molluscs and those of Queensland, that of 573 species, enumerated in Issel's *Malacologia del Mar Rosso*, no less than 133, inhabit the seas of our State. It is necessary to mention that Issel's list contains bivalves as well as gasteropods.

Woodward\* in his *Manual of the Mollusca*, says, "of the 408 mollusca of the Red Sea collected by Ehrenberg and Hemprich, 74 are common to the Mediterranean from which it would seem that these seas have communicated since the first appearance of some existing shells. Of the species common to the two seas, 40 are Atlantic shells which have migrated into the Red Sea by way of the Mediterranean, probably during the newer Pliocene period; the others are Indo-Pacific shells which extended their range to the Mediterranean at an earlier age." Fisher† points out that this statement is in part incorrect, some of the so-called Red Sea shells having been collected off

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\*Reprint of 4th Edition, 1890, p. 73.

†*Manuel de Conchylogie*, p. 159.

the Syrian and northern Egyptian coasts. The Revd. A. H. Cooke, says\* that "of 818 shells collected by Macandrew at Suez, 17 are undoubtedly Mediterranean."

It would be well to try and ascertain in what geologic age the great equatorial current swept in an unchecked stream across the Pacific, Indian and Atlantic Oceans, carrying with it the vivifying warmth acquired in its long course through tropical seas. In the Cretaceous age the southern type of the system attained a great development on both sides of the Mediterranean basin, and covered a vast area of the north of Africa. In the Sahara region, forming the interior of Algeria, it extends in broad plateaus, ending in abrupt escarpments, showing the varied outlines that might have been an old shore line. In these rocks the various Cretaceous subdivisions from the Neocomian upwards have been recognised. One important member of the system forms the upper part of the "Nubian Sandstone," which is so important a factor in determining the character of the landscape in north-eastern Africa. This formation extends eastwards into Syria, and is found in the region of the Lebanon. In the Eocene epoch the most widely distributed marine deposit is represented by the nummulitic limestone, which extends from the Alps to the Caucasus, through northern Africa, from Persia to the Suleiman Mountains, and is found again in China and Japan. Lyell† says of it—"The nummulitic limestone is of world-wide extent, and contains many corals of large size, of genera now common in tropical seas, some of the same fossil species ranging from Scinde in India to the West Indies." A. Geikie‡ believed "that the open Cretaceous sea must have stretched through the heart of the Old World."

The Cretaceous fauna, as seen in European formations, includes such genera as *Strombus*, *Fusus*, *Fasciolaria*, *Oliva*, *Pleurotoma* and *Conus*, and, in India, *Cypræa* and *Voluta*, which in the present age are most abundant in warm seas."§ In Eocene times the affinities of the

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\*Cambridge Natural History, Molluscs and Brachiopods, p. 369.

†Principles of Geology, Vol. I., p. 207.

‡Geology, p. 325.

European molluscan fauna, with those families now inhabiting the Indian and Pacific Oceans, becomes much closer, the most prominent forms representing the following genera:—*Cancellaria*, *Fusus*, *Oliva*, *Voluta*, *Conus*, *Mitra*, *Rostellaria*, *Pleurotoma*, *Cypræa*, *Scalaria* (*Epitonium*), etc.

In these two periods, when the connection between the Indian and Atlantic Oceans, across Northern Africa and the basin of the Mediterranean, appears to have been wide and complete, the climate must have greatly modified by the flow of a vast current warmed in equatorial regions; and, though there are undoubtedly other causes that have modified terrestrial climate since Miocene times, sufficient stress does not seem to be given to the presence in recent times of the two great barriers, the isthmuses of Suez and Panama. These, by causing the equatorial current to be deflected, first round Cape Agulhas and then round Cape Horn, united with the influence of the west wind drift, change it to a cold current on the southern and western extremities of Africa and America.

When we contrast the climate of British Columbia with that of Labrador in the same latitude, we have evidence of the striking results caused to the one by the warm Japan current of the Pacific, and to the other by the cold Labrador current that sweeps down from the Arctic into the Atlantic.

Wallace\* expresses his belief in a former connection of the Indian and Atlantic Oceans thus:—"We also know that a little earlier, in Eocene times, tropical Africa was cut off from Europe and Asia by a sea stretching from the Atlantic to the Bay of Bengal, at which time Africa must have formed a detached island-continent such as Australia is now, and probably, like it, very poor in the higher forms of life.

Huxley† also expresses the same opinion, as follows:—"There is every reason to believe that both Hindustan, south of the Ganges, and Africa, south of the Sahara, were separated by a wide sea from Europe and North Asia during

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\*Island Life, p. 418.

†Anniversary Address to the Geological Society, 1870.

the Middle and Upper Eocene epochs. . . . Some time during the Miocene epoch, the bottom of the Nummulitic Sea was upheaved, and converted into dry land, in the direction of a line extending from Abyssinia to the mouth of the Ganges.

The earth movements that severed the connection of the north-west portion of the Indian Ocean with the Mediterranean, caused the Red Sea to retreat to its present limits, but it still maintained its union with the great Indo-Pacific province, and the character of its molluscan fauna remained unchanged. The Mediterranean Sea no longer traversed by a warm equatorial current, lost most of its genera that are typical of the Indian, Malaysian and Australasian sub-regions, and, maintaining its connection with the Atlantic, gave to its mollusca a northern *facies*. The presence of isolated species belonging to tropical genera like *Fasciolaria*, *Cancellaria*, *Sigaretus*, *Cymbium*, *Cypræa*, *Marginella*, *Mitra*, *Cassis* and *Pisania*, is strong testimony that the Mediterranean region was formerly a part of the great waterway of the equatorial current.

To the north of Australia the extension of the typical molluscan fauna of Queensland is equally wonderful. The Philippine Islands lie 3,500-4,000 miles from our shores, yet the appearance of its molluscan fauna would be perfectly familiar to the Queensland collector. Of our 1,619 species of Gasteropoda, no less than 673, or over 40 per cent., are known to inhabit the shores of this distant archipelago. Of 18 additional species to our fauna, found in collections sent down from Murray Island, Normanton and Torres Straits, no less than half are also reported from the Philippines, showing that the affinities are still greater if we make the comparison between the shells of our northern coast and those of this distant group of islands. Wallace's Line, though it may separate land faunas of very dissimilar nature, forms no hindrance to the spread of marine molluscs.

As American collectors reveal to us the wealth of material which the Philippine Archipelago affords, as settlement progresses in Northern Australia, and when the discovery of intermediate forms has reduced the number

of supposed species, the two faunas will show still more striking points of agreement.

The only inference to be drawn from this remarkable similarity in marine life is that, however much the areas of the intervening islands may have been extended or diminished in the successive geological epochs, between Queensland and the Philippines an open sea has been maintained through a vast series of years.

Wallace, when accounting for the differences in animal life of the land faunas of the various East Indian Islands, sheds some light on the question under discussion in the following statement:—"Beginning in late Miocene times, when the deposits on the south-east coast of Java were upraised, we suppose a general elevation of the whole of the extremely shallow seas uniting what are now Sumatra, Java, Borneo, and the Philippines with the Asiatic continent, and forming that extended equatorial area in which the typical Malayan fauna was developed. After a long period of stability, giving ample time for the specialisation of so many peculiar types, the Philippines were first separated, then at a considerably later period, Java; a little later, Sumatra and Borneo; and finally the islands south of Singapore to Banca and Billiton."

In other directions the same conclusions must be made. As the islands of Melanesia and Polynesia come under European influence and their molluscan life is made known, the astonishing range of species found on our shores is extended. Of 487 species or marked varieties collected by Mr. C. Hedley at Funafuti, one of the Ellice Islands, no less than 261 also inhabit Queensland; and a definite, but decreasing relationship is shown as we study the marine shells of New Caledonia, Fiji, Samoa, Tonga, the Paumotus and the Sandwich Islands.

Darwin,\* in his "Voyage of a Naturalist," states that of 90 shells collected by Cummings at the Galapagos, 25 are found on the west coast of South America, and 18 are natives of the Low Archipelago or of the Philippines. The Galapagos group therefore marks the junction between the Western South American and Indo-Pacific provinces; the

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\*Sir John Lubbock's Edition, p. 285.

stretch of deep sea parallel to, and west of the Andes, separating two very different conchological faunas.

A study of the molluscs of the Pacific coast of Mexico and Central America shows that 17 species known in Queensland also inhabit those distant waters. They are in some cases of genera like *Hipponix*, *Cheilea* and *Ianthina*, which, from their mode of life, are easily and widely spread; but include others such as *Natica*, *Drupa* (*Ricinula*), and *Pyrene* (*Columbella*) which have no special means of dispersal in adult life.

Of the barrier between the equatorial portions of the Pacific and Atlantic formed by Central America and the Isthmus of Panama, Geikie\* says:—"While the fishes and molluscs living in the seas on the two sides of the Isthmus of Panama are on the whole very distinct, a few shells and a large number of fishes are identical; whence the inference has been drawn that though a broad water-channel originally separated North and South America in Miocene times, a series of elevations and subsidences has since occurred, the most recent submersion having lasted but a short time, allowing the passage of locomotive fishes, yet not admitting of much change in the stationary molluscs. Of species found on the Atlantic side of America, in the West Indies, Florida and Brazil, 35 are also found in Queensland; two of these are reported doubtfully, and may be rejected; the remainder include species of *Fissurella*, *Hipponix*, *Litorina*, *Tectarius*, *Planaxis*, *Epigrus*, *Rissoina*, *Litiopa*, *Cerithium*, *Ianthina*, *Epitonium* (*Scalaria*), *Cymatium* (*Triton*), *Distortrix*, *Septa* (*Triton*), *Cassis*, *Tonna* (*Dolium*), *Trivia*, *Oliva*, *Murex*, *Hydatina* and *Pyrene* (*Columbella*).

Geikie's use of the term "stationary molluscs" is rather misleading. It may be true that they deserve that title in adult life, but the immature mollusc in the veliger period is a great traveller, floating over widespread areas before coming to rest. Many of these juvenile forms, before their proper place in molluscan history was understood, have been regarded as species, and given such names as *Macgillivrayia* *Sinusigera*, etc. This power of ranging

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\*Geikie, Text Book of Geology, I., 391.

widely over ocean waters is also possessed by the sea creatures formerly placed in a separate class as *Pteropoda*, but now regarded as molluscan forms whose life-cycle has been arrested at the free floating marine stage. The Rev. A. H. Cooke,\* M.A., states the case as follows:—"The *Pteropoda* are a group whose true relations are masked by the special conditions of their existence, which has tended towards the development of certain organs, the so-called 'wings' and the shell, which give them an apparent symmetry; this symmetry disappears on a close investigation of the internal organs." This author reduces the *Pteropoda* to a sub-class of the mollusca.

Recapitulating, the aim of this paper is to show from the distribution of Gasteropods, geographically and geologically, that the shell-fish of the great Indo-Pacific province were almost universally spread through warm temperate and equatorial regions to the end of Eocene times; but that the north and south barriers, formed by the elevations that produced the Isthmuses of Suez and Panama, limited the range of species to the two oceans that are connected in tropical areas, and by giving rise to modifications of climate in the Atlantic and Mediterranean basins, caused great changes in the character of their molluscan faunas.

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\*Cambridge Natural History, Brachiopods and Molluscs, p. 435.

# NOTES ON THE CYANOGENETIC GLUCOSIDE OF EREMOPHILA MACULATA.

(NATIVE FUCHSIA.)

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**By FRANK SMITH, B.Sc., F.I.C.**

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(Read before the Royal Society of Queensland, 26th August,  
1913.)

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THE occurrence of an hydrocyanic acid yielding glucoside in a member of the exclusively Australian natural order Myoperinae, *Eremophila Maculata*, was first noted by the author and J. C. Brünnich, F.I.C. (Queensland Agric. Journ. XXV., 291) in November, 1910, in pursuance of an enquiry into the cause of mortality among stock on Carondotta and Roxbrugh stations in the Boulia district.

In the interim an attempt has been made to isolate the glucoside, and though unsuccessful, it is proved to be one of the Amygdalin group, probably difficultly crystallisable, and yielding on decomposition with emulsin benzaldehyde, hydrocyanic acid and reducing sugar.

The observation that the glucoside and the enzyme necessary for its decomposition occur separately in leaves and fruit respectively, could not be confirmed on subsequent specimens of the plant. Though not actually resulting in the separation of the glucoside in the pure state, the details of the experimental work performed may be cited.

## EXPERIMENTAL.

One kilo of dried leaves including a small quantity of fruit, after preliminary extraction with petroleum ether, was thoroughly extracted with 90 per cent. alcohol, and

the resinous material obtained on evaporation of the solvent treated with water. The aqueous solution, precipitated by basic lead acetate, and excess of lead removed by  $H_2S$ , was concentrated under diminished pressure, taken up in alcohol and finally extracted with ethyl acetate.

The brown syrup obtained on evaporation of the solvent showed no sign of crystallisation even on standing several months, and was without appreciable reducing action on Fehling's solution.

It was further taken up in water when addition of acetate of lead produced further small quantity of yellow precipitate.

The solution freed from lead and concentrated to a syrup was repeatedly taken up in alcohol and fractionally precipitated by addition of ethyl acetate and ether when small quantities of resinous material were deposited.

The decanted liquor on concentration in partial vacuo did not crystallise, nor could crystallisation be obtained by use of a mixture of ethyl acetate and toluene as recommended by Herissey (J. Chem. Soc. Abr., 110, pt. 1, 31).

An attempt was made to prepare the acetyl derivative of the glucoside by boiling a quantity of the crude syrup with acetic anhydride. The oil obtained by pouring into water was washed with 5 per cent. sodium hydroxide solution to free from acidic substances and finally thoroughly with water.

It was completely soluble in ethyl acetate, chloroform, ether, and 95 per cent. alcohol, and evaporation of the last mentioned solvent yielded a quantity of rhombic crystals. These were purified by two crystallisations from hot 95 per cent alcohol and were found to melt sharply at 123 degrees C.

This melting point is identical with that of tetra-acetylprulaurasin, though from its sparing solubility in cold alcohol and its crystalline form it could not be identified with that substance. The amount available did not permit of further experimental work. Cooling of the mother liquors to  $-5$  degrees C. gave a further quantity of similar crystals, and also a small quantity of needles, apparently orthorhombic, though it was found impracticable to effect the separation of the two substances.

Caldwell and Courtauld (J. Chem. Soc., 107, 91, 666) state that tetra-acetyl-prulaurasin separates from concentrated alcoholic solution in orthorhombic needles at  $-5^{\circ}$  C., and that prulaurasin is difficultly crystallisable. Prulaurasin, therefore, is probably present in *Eremophila maculata*.

A portion of the crude syrup (9 grms. in 50 ccs. of water) was decomposed by .05 gm. of Merck's emulsin and distilled in steam. The distillate contained hydrocyanic acid and benzaldehyde, the latter being positively identified by the formation of its phenylhydrazone (M.Pt.  $153^{\circ}$  C.). The liquid from the distillation flask was found to reduce Fehling's solution strongly, and after precipitation with lead subacetate yielded with phenylhydrazone the typical osazone of glucose.

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# THE PLANTS OF MAST-HEAD ISLAND.

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By H. A. LONGMAN.

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(Read before the Royal Society of Queensland, June 27th, 1913.)

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MUCH prominence has been given of late years to the study of island floras, perhaps the most noted instance being that of Krakatau\*. In 1883, the entire vegetable life there was blotted out of existence by lava streams, the result of a volcanic eruption so gigantic that the sound of it travelled 3,000 miles and was heard here in Queensland. Yet to-day this island is so thickly clothed with vegetation that in places it is almost impenetrable, and an object lesson has been given of the manner in which organisms re-establish themselves on island homes. The interest taken in the flora of Krakatau is an incentive to Australian botanists to note the growth of vegetable organisms on those islets of our Great Barrier Reef which are known to be of comparatively recent origin.

The respective theories of elevation and depression, formulated by Murray and Darwin, to account for the growth of coral islands, and somewhat strenuously advocated by adherents of each school, are now found to be both correct. Whilst certain coral atolls are due to depression, others are indubitably formed by elevating influences. The whole of the Barrier Reef region is, of course, the result of subsidence, but varying factors have contributed to-

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\*New Flora of Krakatau, A. Ernst; English trans. A. C. Seward, Cam. Univ. Press, 1908.

Some doubt has been expressed as to whether the nuts of *Cocos nucifera*, Linn., the cocoanut palm, ever germinate naturally when cast upon a beach, and in the majority of cases they evidently fail so to do. But in the Flora of Krakatau definite evidence is given that a large number of these valuable palms have established themselves on that island by natural methods.

wards the formation of its many islands. Mr. Charles Hedley\*, to whom we are indebted for considerable information respecting Mast-Head Island, considers that it was formed by the action of tides in the shallow waters. Drifts of sand apparently develop, and through the interaction of lime and water a core of rock is formed. Depositions of matters are constantly added to its bulk, until we have an island centre, and a lagoon, suitable for the growth around of a wonderful world of coral organisms. The island sand is soon enriched by the excretæ of birds and it forms a fit soil for the development of a wealth of vegetable life. The great Greeks who worshipped art conceived their goddess of love and beauty as rising from the pure waters of ocean. And is not much of the glamour and fascination experienced by visitors to one of these coral islands on the Barrier Reef due to the fact that these little paradises are sea-born—the work of the waves and of ocean organisms?

Mast-Head Island is situated just outside the Tropic of Capricorn, 31 miles from the mainland near Port Curtis, and is but 160 acres in extent.† The outstanding feature of its botany is the luxuriance attained, although comparatively few forms participate. Apparently the potentialities of the environment, so far as Phanerogams are concerned, are utilised to almost the same extent as though treble the number of forms were competing for sustenance. We have here a striking illustration of the advantages to an individual species of an island habitat where the struggle for existence is less keen than on the mainland. Of the first plants established, a very large proportion of offspring must have survived. We may expect in such insular floras opportunities for the development of variations which the curtailing influences of Natural Selection might stamp out in less congenial habitats. The position is somewhat analogous to some of Luther Burbank's experiments, where, in order to get all possible variations, the fullest scope is given to every seed of the selected plant. Both in botany and zoology we find island varieties of mainland species. A surprising number of specimens

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\*Proc. Lin. Soc., N.S.W., 1906, Vol. XXXI., part 3

†Commonwealth Year Book, 1912, p. 60.

from island habitats appear in records with no specific name attached or are noted as varieties. This is particularly true of the Challenger Volume by Hemsley, on Insular Floras. In certain species a change in environment tends to increase variability, and this is surely true of many plant immigrants on islands.

The study of insular floras reveals successive stages in plant colonisation. My list from Mast-Head numbers only twenty-six species, two of which are but carpological and represent unestablished forms. There may be, of course, additional annual plants, not found during our visit.\* We may anticipate that a census taken some years hence will show an increase, even though some species fail to survive. The majority of the plants found are naturally conspecific with those on the adjacent coastal districts. With these the most interesting point is not a mere enumeration of names, but an inquiry as to the method of colonisation. Primary importance should be given to ocean currents. I was fortunate in securing a pod of *Castanospermum australe*, A. Cunn., the Moreton Bay Chestnut, which had been washed high on the beach, and which in the ordinary course of things might have taken root and flourished. Our veteran botanist, Mr. F. M. Bailey†, has noted a fruit of *Parinarium laurinum*, a Rosaceous tree found in Fiji and the Samoan Islands, which was secured in a similar position on the island in 1907. In this connection it is interesting to remember the experiments of Darwin, Guppy, Ch. Martins and others, demonstrating that long immersion in sea water fails to rob many seeds of their vitality. *Casuarinæ* and *Pandani* flourish on coral sand debris, and are usually among the first comers brought by ocean currents. Associated with them is the common seashore grass, *Thuarea sarmentosa*, which has valuable binding properties in loose sand. Mast-Head is circled by a gray-green belt of *Casuarina equisetifolia*. The small cones of these trees sink in the water when green, but when somewhat dry they float and retain their vitality for several days. Other plants in my list, the seeds of which probably reached the island by ocean currents are *Sophora*

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\*Qld. Univ. Biol. Students' Trip, Sept., 1912.

†Qld. Agric. Journ., Feb., 1907, p. 76.

*tomentosa*, *Abutilon mulicum*, *Sesuvium portulacastrum*, *Tribulus cistoides*, *Tournefortia argentea*, *Ipomœa pes-caprae*, *I. Turpethum*, *Boerhaavia repanda*, *Euphorbia atoto*.

As an interesting sidelight on the growth of knowledge on this point, it is worth while noting an article by Charles Moore on the flora of Lord Howe Island, read before the Royal Society of N.S.W., and published in their Transactions of the year 1871, in which he frankly expresses his disbelief in the agency of ocean currents except in the case of such fruits as the cocoa-nut.

Several species are stated to have the advantage of two methods of transport. The seeds of *Cassytha* are found in the crops of carophagous birds and are also said to be conveyed by ocean currents. The same applies to the seeds of many grasses.

Some seeds are unquestionably transported in earth adhering to the roots of trees, sent adrift by storm or flood, and which find a resting place on the beaches of islands. The amount of timber seen in the drift zone at Mast-Head was remarkable. The island is celebrated for its multitudes of birds, and by their agency some of its plants must have been introduced. Birds are usually credited with the transport of the inland portion of an island flora. In dealing with so small an island, the term inland flora, in contradistinction to the drift zone and the strand area, seems a little incongruous, and except that at Mast-Head the *Pisonia* trees were found in the centre, and *Casuarinas* on the shores, no rigid demarcation should be made. Among the fruits eaten and dispersed by birds may be mentioned, in addition to *Cassytha* and the grasses, *Ficus* (two species) and *Solanum nigrum*, but for want of fuller knowledge on this subject, I do not care to add to the list. Banfield\* has compared *Pisonia Brunoniana* to the fabled Upas tree because the viscid substance coating its seeds is comparable to birdlime and it ensnares and occasionally causes the death of small birds. So many insects perish in the gummy envelopes that Banfield asks whether it may not be to the advantage of these seeds to have animal matter present to assist them in germinating. J. A. Leach† refers to the

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\*"Confessions of a Beachcomber," p. 207.

†"An Australian Bird Book," p. 36.

“wonderful partnership” between the noddies and this tree, adding, “The birds are sometimes so loaded and clogged with these fruits that they are incapable of flight.”

The seeds of some of the smaller plants are often conveyed in mud attached to birds, and in this connection we have Darwin’s classic illustration of 82 seeds germinating from a ball of hard earth found on the leg of a partridge. The well-known *Plumbago zeylanica*, which is firmly established at Mast-Head, has a glandular calyx surrounding the fruit and which falls off with the ripening seeds. This sticky calyx is doubtless responsible for the transfer of seeds, for this widely-spread species is found in most of our scrubs.

It is with diffidence that one mentions the possibility of wind dispersal in regard to the plants in my list. Of the two Composites found on the island, the *Wedelia* has no pappus, but the seeds of *Gnaphalium luteo-album*, a very common weed, may well have been blown from the mainland.

As Mast-Head has been visited at various times by camping parties, it is by no means unlikely that man himself has unintentionally been responsible for the conveyance of some species.

Only one parasitical plant was found, that being *Cassytha filiformis*. Species of *Loranthus* are very commonly found on *Casuarinas*, but they have as yet failed to establish themselves at Mast-Head.

No fungi, lichen or mosses were noted; perhaps the season and the time of the year were partly responsible, but no careful search was made for such small forms as usually escape ordinary notice.

A large number of Mast-Head plants represent very widely-spread species, and among them are some of the most successful colonists of the vegetable world. *Tournefortia argentea* was collected by Darwin at the Keeling or Cocos Islands, 600 miles from the nearest land. Taking the areas of Continental Asia, Polynesia, Australia, Africa and America, as tabulated by Hemsley, we find that seven of our plants have the full range: *Tribulus cistoides*, *Sophora tomentosa*, *Sesuvium portulacastrum*, *Boerhaavia repanda*, *Achyranthes aspera*, *Cassytha filiformis* and *Casuarina*

*equisetifolia*. Several of the other species are also widely dispersed, and it is thus evident that this island has been reached by some of the most ubiquitous of plants.

One of my specimens, *Stenolaphrum subulatum*, an ally of the Buffalo grass, is a new record for Australia. It is a common grass in New Guinea and Fiji, and will doubtless before long establish itself on our mainland. A variety allied to this species was secured from the south-eastern Moluccas during the Challenger expedition and may prove to be intermediate between *subulatum* and *americanum*.

Leaving on one side the fruit of *Castanospermum australe*, we have only three Mast-Head species which should be classed as truly endemic to Australia. These are *Euphorbia eremophila*, *Ficus opposita* and *Pandanus pedunculatus*.

As several *Pandani* are mentioned from islands in the Pacific but with no specific name attached, the range of this last species may need to be enlarged. According to Bentham our *Abutilon muticum* agrees with specimens from tropical Asia, generally referred to *A. asiaticum*\*

My thanks are due to Mr. F. M. Bailey and his assistant, Mr. C. T. White, for help with one or two difficult specimens. I should also like to take this opportunity of expressing my obligations to Mr. J. H. Maiden for his ever-ready assistance to botanical workers.

#### Order CRUCIFERÆ.

*Senebiera integrifolia*, D.C., var. *scaber*, Bail.†  
(R.A.O.U., Excur. 1910. Not seen in 1912.)

#### Order MALVACEÆ.

*Abutilon muticum*, G. Don.

#### Order ZYGOPHYLLÆ.

*Tribulus cistoides*, Linn.

#### Order LEGUMINOSÆ.

*Sophora tomentosa*, Linn.

*Castanospermum australe*, A. Cunn. (Fruit only.)

#### Order ROSACEÆ.

*Parinarium laurinum*, A. Gray (Fruit only.)‡

\*Benth. Fl. Austr., i, 204.

†Qld. Agric. Journ., Nov., 1910, p. 234.

‡Qld. Agric. Journ., Feb., 1907, p. 76.

## Order FICOIDEÆ.

*Sesuvium portulacastrum*, Linn.

## Order COMPOSITÆ.

*Gnaphalium luteo-album*, Linn.

*Wedelia* (not seen by writer; noted by ornithologists; probably *W. biflora*, D.C.).

## Order PLUMBAGINEÆ.

*Plumbago zeylanica*, Linn.

## Order BORAGINEÆ.

*Tournefortia argentea*, Linn.

## Order CONVULVULACEÆ.

*Ipomœa Pes-caprae*, Roth.

*Ipomœa Turpethum*, R. Br.

## Order SOLANACEÆ.

*Solanum nigrum*, Linn.

## Order NYCTAGINEÆ.

*Boerhaavia repanda*, Willd.

*Pisonia Brunoniana*, Endl.

## Order AMARANTACEÆ.

*Achyranthes aspera*, Linn.

## Order LAURINEÆ.

*Cassytha filiformis*, Linn.

## Order URTICACEÆ.

*Ficus opposita*, Miq.

*Ficus*, sp.

## Order EUPHORBIACEÆ.

*Euphorbia atoto*, Forst.

*Euphorbia cremophila*, A. Cunn.

## Order CASUARINEÆ.

*Casuarina equisetifolia*, Forst.

## Order PANDANACEÆ.

*Pandanus pedunculatus*, R. Br.

## Order GRAMINEÆ.

*Thuarea sarmentosa*, Pers.

*Stenotaphrum subulatum*, Trin.

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# UNDERGROUND WATERS.

(WITH SPECIAL REFERENCE TO SOUTH AUSTRALIA AND  
QUEENSLAND.)

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## I.

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By **THOMAS PARKER, F.G.S.**

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*Read before the Royal Society of Queensland, May 27th, 1913.*

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### RESEARCHES IN GREAT BRITAIN.

A GREAT impetus to the study of underground waters—that is water subterranean, sub-artesian, and artesian—was given by the researches in Great Britain of the British Association for the Advancement of Science. A Research Committee was appointed in 1874, and their work was spread over a number of years. At the commencement of that committee's investigations a list of questions was sent out to voluntary observers in different parts of the country. These questions had relation to the wells in their localities, the depths, and yields of water, the variations of the water levels in the wells in dry and wet seasons, and other important points. At an early stage of this inquiry the decision was arrived at that the source of underground waters was the rainfall by percolation from the surface.

### NOTES ON SOUTH AUSTRALIA.

About this time I was engaged in making engineering surveys in connection with water conservation and irrigation in various localities in South Australia. During this work I met some striking instances of the great amount of percolation of the rainfall below the surface of the country. In the Willochra Valley, during the great drought of 1885-6, the ground in many parts was covered with large cracks and fissures, extending down into the subsoil for a considerable depth. From this I concluded that, during the

season of heavy rainfall which followed, a very great proportion of the rainfall would disappear underground. Here is another instance of excessive percolation. In the bed of the Wakefield River, during a dry season, I noticed a large number of wide cracks in the river bed, into which during the next flood the water poured, and arrested the river channel flow for some time. This shows what large quantities of the rainfall percolates and goes underground. These observations of great percolation confirmed my opinion, largely held by others, that underneath the beds of most rivers and streams there is a subterranean stream following a direction and gradient similar to that of the river at the surface.

#### URGING THE COLLECTION OF DATA.

In South Australia I found that, with the exception of rainfall records, there were at that time little data upon which to base conclusions as to the feasibility of works of water conservation and irrigation. In order to arrive at a thorough knowledge of the underground waters I urged on the Government the great need of systematic gauging of the water flowing in the rivers, and showed that this work, and the measurement of evaporation and absorption, were quite as important as the survey of the lands and the mineral-bearing areas of the country. Soon after this the work of gauging the rivers of South Australia was initiated. I made similar recommendations in Queensland about five years ago, and I am pleased to hear that river gaugings have since been begun in this State.

#### UNSCIENTIFIC SEARCH FOR UNDERGROUND WATER.

The search in South Australia for suitable sites for bores and wells at the dates referred to had not been always conducted under the guidance of recognised scientific principles. Artesian water had been found in some localities, and a speculative use of the boring rod was frequently made. The tendency was to take the most hopeful view of the prospect in connection with many of these earlier ventures in search of water. The professor of the divining rod was then, and even up to the present is, too much in evidence.

I may here relate an interesting test I had the opportunity of making of the work of a divining-rod practitioner. One of these had applied to the South Australian Government to be appointed as water finder. The matter was referred to me for inquiry and report. I proceeded with the diviner and a number of interested visitors to the Plain of Adelaide. After a locality was selected for the test the operator moved about with the rod held in his hands in the usual way. At the bending down of the forked twig at certain spots I had pegs driven to mark the places. I next proposed to sink bore holes at these spots marked by the pegs, having with me some men and boring appliances.

Before beginning the borings I asked the practitioner of the rod what was his opinion about the points which the rod had passed over without turning down. Did he consider water could be found under these places? After having this question put to him more than once, the operator at length declined to answer. Several of the visitors from other States agreed with me that it was a fair inquiry to make. The only reply obtainable was: He considered it was only a catch question.

I then had borings made, both at the points marked by the pegs and at two other points where the rod passed over without turning down. The result was that, the ground being soft and the boring easy, water was soon reached, being found at a shallow depth. The borings went on, and water was reached at a similar depth at all the places, as water prevailed under the locality generally.

The conclusion I arrived at was that the turning down of a divining rod, by whatever force it may be produced, is not a reliable guide to the presence of water under the surface at the spot where the rod turns down.

#### UNDERGROUND WATER EXPLORATIONS SCIENTIFICALLY GUIDED.

A very important question may be asked here. What progress has been made in Australia towards a scientific method of exploring for underground water supplies, artesian or otherwise, previous to sinking or boring? As far as I have ascertained neither America nor Australia can report much progress towards a solution of the problem. In a

recent official report in the United States it is stated " Much blind optimism prevails on this subject." This is also true, to a large extent, of Queensland, with the exception of some able work done by the Geological Department. Measuring evaporation and gauging the run-off in the rivers have been left undone until recently. I began this work in South Australia 25 years ago. Such data are necessary to solve the problems of the source of the artesian wells, and the permanency or otherwise of their flow.

#### A METHOD OF EXPLORATION.

I would again emphasise the importance of the question: what is the best scientific method of exploration for underground waters? As a contribution to the answer to this I shall now describe some work I undertook some years ago in that direction. I had to examine the Willochra Valley, in South Australia, where a water supply was required for railway purposes. I was instructed to make an engineering survey, and report on the proposed construction of a large dam on the Willochra Creek to conserve water in the valley. I found the locality, after examination and survey, not at all suited for that kind of scheme, and considered a work of that nature probably would prove an abortive one.

Before preparing my report, I decided to examine the neighbouring Coonatto and Flinders Ranges. To enable me to decide on the probability of discovering an underground supply of water there, I took levels of the mountain slope with the aneroid barometer, measured the depth of some wells, in the foot hills, yielding good potable water. From these and other data obtained in the locality I prepared a hydro-geological sketch section across the valley. In this section I indicated the underground water surface or line of saturation. This was obtained by joining the points, indicating the water level in the wells. Then, inferentially, I indicated the probable course of the underground water, by producing this line of saturation down to the bottom of the valley, intersecting the line of railway at the township of Bruce. I then reported on the probability of underground water being found near the

railway at the depth indicated in my sketch section. On a bore being sunk there, good water was found at about the depth indicated in my section. I adopted the system whilst in South Australia up to 1889, a step in advance of the old haphazard method.

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# UNDERGROUND WATERS

(IN SOUTH AUSTRALIA AND QUEENSLAND.)

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## II.

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**By THOMAS PARKER, F.G.S.**

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*Read before the Royal Society of Queensland August 26th,  
1913.*

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### FURTHER NOTES ON SOUTH AUSTRALIA.

ANOTHER stream of underground water, which I examined during my water explorations in South Australia, was from a catchment on Mount Lofty. This stream, though not artesian, was of interest as showing the grade of the underground flowing water. Coming from the range behind Adelaide, it passed thence under that city, towards the sea, and at increasing depths along the line of its flow. The depth at Glen Osmond, on the foot-hills, was 40ft. from the surface; at Adelaide, 70ft.; at Kilkenney, nearer the sea, 118ft.; and under Port Adelaide probably at a greater depth, as a bore made at the port down to 100ft. from the surface did not reach the underground water. It is most probable that this underground water passes under the sea bottom of the Gulf of Saint Vincent, and finds an outlet further seaward.

### A WATER-LOGGED VALLEY IN QUEENSLAND.

One of my first studies of the underground waters of Queensland was the large subterranean storage of water on the western side of Rockhampton. This extends to Warren, on the Queensland Central Railway, a distance of 18 miles. The water is found at a depth from the surface of about 22ft. As the rise of the surface between the two places just named is 150ft., the slope of the surface of this underground water will be about 8.3ft. per mile, and the water must be a flowing stream. Some years ago I made an examination of this body of water by means of bores,

trial shafts, and surface surveys, and found the storage an extensive one, and the water in the drift sand had been tested in one locality to a depth of about 50ft. of water and find sand. I afterwards had an opportunity of determining the source of the supply as coming from the mountains near Stanwell, Mount Morgan, and Lion Mountain. Near Stanwell a large number of creeks unite, and the combined waters percolate under the sandy bed of Neerkol Creek. In the lower part of the valley of this creek, right on to Rockhampton, the water flow is mostly underground. The stream appears to pass under the flats west of Rockhampton, and the railway at Yeppen, and probably finds its way into the Pacific Ocean.

#### THE ARTESIAN WELLS OF WESTERN QUEENSLAND.

The advancing surveys and delimitation of the great Australian basin enable us now to form some conception of the paramount interest which Queensland has in the artesian water question of Australia. The total area of this basin is about 481,000 square miles, of which near three-fourths is in Queensland, and the remainder in New South Wales and South Australia. Since the discovery of the existence of this immense basin some hundreds of artesian wells have been sunk, and the daily flow was given recently as 529 million gallons; this, however, is probably only a fractional part of the water percolating on the catchment, going down to maintain the flow of the underground streams, so that the artesian wells are not likely to diminish in yield for want of water to maintain their supply. The prominent features of these wells are the great diversity of chemical contents of the waters, the varieties of rocks bored through, and the temperature of the waters at the surface. At Longreach, for instance, where I designed and carried out works for laying on the bore water to the town, the water is of high temperature, also is so high in saline contents as to render it unsuitable as a potable water. Still, it is found most pleasant for bathing, of great use for domestic purposes, for fire extinction, and for manufacturing purposes. The beds passed through by the boring were mostly shales down to the water-bearing beds.

## OUTLETS TO THE OCEAN.

Another condition of these artesian waters is that they find an outlet to the sea at points greatly distant from the locality of their intake. Mr. A. Gibb, Maitland, formerly of the Geological Department of Queensland, some years ago reported on the leakage of Queensland artesian waters into the sea. He said that, as is the case in Queensland, nearly all the important artesian water basins of the world leak into the sea, or present facilities for the escape of water at a lower level than that at which it is received. My researches in South Australia and Central Queensland also lead me to the same conclusion that the ocean is largely the ultimate destination of underground waters. Reasoning then, as I think one may, from the analogies of artesian basins in other countries, it appears a safe inference that the underground waters of Western Queensland are not a motionless reservoir of water, but a moving stream; a stream passing onward through the porous rocks and the fissures and openings of the several rock formations in which the water is found.

## IS CLOSING OF ARTESIAN WELLS DIMINISHING THEIR FLOW ?

It is well-known that the flow of artesian wells in Queensland and New South Wales has diminished during recent years. The most common cause of reduced flows, according to some American experience, is improper casing, and these have existed from the beginning of the well. In other cases the failure of flow is ascribed to poor jointing or packing. In other instances a friable rock has been fractured by the boring tools, and this part of the bore has been subjected to caving.

From these and similar causes the leaks around the casing or into adjoining porous beds may easily cause a diminution of the flow, or lead to the total loss of the flow of the well.

Some remarkable evidence on this question has been given by Mr. R. S. Symmonds, of New South Wales, which goes to prove that closing down artesian bores is an injurious practice. Mr. Symmonds describes 19 bores in which the closing of the valve at the surface was followed by a rush of water outside the bore, causing permanently

decreased flow. After explaining in detail the injuries to the bores through closing the valves, he remarks, "It is quite possible, indeed very probable, that this (closing down the valves) is the true reason why many of the flows are diminishing."

In the case of the Longreach town bore, Central Queensland, I found on examining it, before beginning the reticulation works of the town from the artesian bore, the water was flowing almost as much outside the bore casing as within it. Evidently some injury had been done previously to this bore, probably through a shock from water ram. The depth to the water-bearing bed is about 2400ft. ; the pressure of the water at the surface was about 75lbs. to 90lbs. per square inch. The shock from water ram which occurs when a bore is valved down, would be a heavy one, and most probably sufficient to burst the casing, and cause a diminution of the flow inside the bore casing, and also make the water leak away underground. It is well known that if a valve in a line of system or water pipes be suddenly closed while the water is flowing freely under pressure, such sudden closing of the valve will produce a strain upon the pipes far greater than that due to the static head of water. I have known cases where town water pipes were burst by the closing of the street valve, and water ram caused by such closing. The bursts occurred so frequently that the matter was investigated by me, and it was found the bursts of pipes were caused by closing a hydrant valve from time to time, and the pipes were also found weak through corrosion. In the case of an artesian bore well, the bursting of the casing pipe, from water ram and corrosion of the pipe, would show by water coming up outside the casing, or the water would find an escape underground into some porous beds of rock, or some openings in the shale, or some permeable rock through which the bore has passed.

#### WASTE CAUSED BY RESTRICTION OF FLOW.

From inquiries I have made respecting some of the artesian bores of Queensland I consider the facts and conditions point strongly in the direction of the conclusion that the diminished flow of artesian wells is mostly caused by the closing down of the valves, and thereby bursting

weak or corroded casing pipes. I know one district in Western Queensland where galvanised wrought iron pipes have been so corroded by the surface soil contents that the pipes have become worthless by corrosion within two years. Where the casing pipes of artesian wells have suffered by corrosion the shock of closing down the valve at the surface will easily cause the rupture of the casing, and bring about the diminished flow of the wells already described. It would appear, then, that the practice of valving down adopted to prevent waste of artesian water is more likely to have a contrary effect, and rather cause a diminished flow at the surface, and bring about a real waste of the water underground. It may here be asked, What is a waste of the water of a flowing artesian well? Evidently the opinion in some quarters hitherto has been this, that by allowing the unrestricted flow of the bores to the surface much of the water is wasted. Hence the decision to restrict the flow. But I think if the facts and arguments I have presented were taken into account, and fuller inquiry made, it would be found that this unrestricted flow of existing bores is not a waste of the water, although at the first glance it may appear so; also that valving down existing bores does not conserve the underground supply. It should be remembered that the closing down of a bore and stopping the flow, even if it could be done without a water ram shock and consequent damage to the bore, does not necessarily conserve the water. All the time the bore is closed the opening at the ocean end of the underground stream is there. The water into which the bore has originally pierced is not a closed reservoir, but a flowing stream, though moving slowly, hence no water is being actually conserved whilst the bore is closed at the surface, for the stream below is passing the locality of the bore all the time. The water, as before, is flowing down the incline between two watertight strata, which form a kind of water pipe, but one, however, which is open at the lower end. When it is considered what a very large amount of money has been expended on artesian wells in this State, and that the maintenance of that water supply in the arid western areas is of vital public importance, the question of the diminishing flow of the well should be thoroughly investigated.





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# DEVELOPMENT OF PETROLOGY DURING THE PRESENT CENTURY.

(PRESIDENTIAL ADDRESS).

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**By HENRY C. RICHARDS, M.Sc.,**  
Lecturer in Geology, University of Queensland.

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*Read at the Annual Meeting of the Royal Society  
of Queensland, 30th March, 1914.*

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IN 1857 the late Dr. H. C. Sorby communicated to the *Quart. Journ. Geol. Soc.* two very important papers embodying the results of his investigations on the microscopical structure of crystals, with particular reference to the origin of minerals and rocks. Previous to this several other investigators—Cordier, Bunsen, Durocher, Scrope, etc., had been investigating the origin of rocks, but the impetus of Sorby's work was particularly pronounced and has had a very great influence.

Many factors have played a prominent part in the recent advances in Petrology, but the development in physical-chemistry, the more intimate knowledge of the structure of the earth's crust, the accumulated knowledge of the distribution of rocks both in space and time, the perfection of optical determinations, and a more intimate knowledge of the specific properties of minerals, have very considerably furthered our knowledge of the origin of rocks, their diversity and genetic relationships.

In petrogenesis the dominating factor at the close of the last century was, perhaps, differentiation, but the application of the principles of solution to the crystallization of igneous rock-magmas by Vogt and his determination of the approximate "eutectic ratios" for a number of pairs of minerals accounted for the theory of eutectics playing the chief role for a few years.

The principles of differentiation, eutectics and the absorption and assimilation of rock-matter by molten rock-

magmas now form the bases of the various hypotheses put forward to account for the genesis and diversity of igneous rocks.

During the present century there have been published several works of an epoch making nature.

Amongst the many important publications we find notably: "The Quantitative Classification of the Igneous Rock," by the four eminent American petrologists, Cross, Iddings, Pirsson, and Washington; "Die Silikatschmelz-lösungen," by Vogt; a "Treatise on Metamorphism," by Van Hise; "Die Krystallinen Schiefer," by Grubenmann; "Natural History of Igneous Rocks," by A. Harker; and the various publications by R. A. Daly dealing with his "Overhead Stopping Theory" and "Alkaline Rocks"; by F. E. Wright on "Microscopic Petrography"; and by Day and others of the Carnegie Institute, Washington, on the physical properties of minerals.

For many years after the application of microscopic methods to the study of rocks, a tremendous amount of descriptive work was carried out and was ready for use in the formation of the generalisations which have been formulated during the present century.

Such has been the influence of the developments of physical chemistry and the various factors enumerated above, that petrology is now rapidly passing from a purely descriptive into an inductive science.

Whitman Cross in his "Review of the Development of Systematic Petrography in the Nineteenth Century," summarises the position at the close of that century as follows:

1. There is as yet no comprehensive and properly systematic classification of all rocks. . . . .

2. Rocks of igneous origin have been much more thoroughly investigated than others and they have received correspondingly more definite and systematic classification. . . . .

3. The rocks which have been formed on the surface of the earth by the destruction of older rocks may be viewed from so many standpoints. . . . . that no consistent arrangement of these objects, deserving the name of a petrographic system, has been proposed.

4. Metamorphic Rocks. . . . . defy systematic treatment at the present time.

The above may be taken to fairly represent the position at that period.

On all four points very great advances have been made since that time; the systematic classification of rocks is on a much sounder basis and the sedimentary and metamorphic rocks have been more closely studied, also we find that as the result of the labours of many, but particularly Van Hise and Grubenmann, metamorphic rocks are now capable of fairly systematic treatment.

The year 1901 was not marked by any great development. Dr. Teall in his Presidential Address to the Geological Society of London, dealt with the consolidation of rocks from molten-magmas and their differentiation into species. After discussing these matters thoroughly in the light of the most recent investigations, he concludes thus: "The origin of petrographical species, so far as the igneous rocks are concerned, is a problem the final solution of which has been handed on by the nineteenth century to its successor."

The year 1902, however, saw the launching of the "Quantitative Classification of Igneous Rocks." by Cross, Iddings, Pirsson, and Washington.

This classification was an entirely new system for the classification and nomenclature of igneous rocks. "It is a chemico-mineralogical system based on its own principles and is in nowise an attempt to reduce any one of the existing systems to a chemical basis, or to formulate any of them in a chemical way." A new nomenclature was demanded in this classification and all igneous rocks are classified on a basis of their chemical composition.

It is essential for the use of this system of classification to know the chemical composition of the rock, either actually by chemical analysis, approximately so by physical means, or by microscopic optical methods indicated by the authors.

This scheme of classification has been most ingeniously worked out, and no doubt was the result of very great labour on the part of the authors. While its adoption has not, however, been universal, it is used to some extent by almost

all petrologists, and in many respects supplied a long felt want.

The amount of criticism levelled at this scheme since its inception has been considerable, and its adoption by the Americans has been more pronounced than by others. Petrologists have been seeking for a truly natural classification of igneous rocks, and perhaps the main objection to the American classification is that it is not a natural one.

The year 1903 was an important one, as several works of great value were issued. Two important memoirs were published by Vogt, of Christiania, "Die Silikatschmelzlösungen," I. and II., and therein he gave his results of certain experiments upon slags, and fused silicates, and showed how the laws of solution may be applied to the crystallization of igneous rock-magmas. The results of researches by Doelter and Ebelmen were also availed of by Vogt in his deductions. Vogt applied the principles of physical chemistry with great success and acted in this way:—Slags of rock-magmas are believed to be solutions; their constituents are known; one can therefore proceed to experiment with their constituents and to predict the behaviour of their mixture according to the principles of physical chemistry.

Vogt made the first comprehensive attempt to apply the principles of solutions to the crystallization of the igneous rock-magmas and even for that alone Petrology owes him a great deal.

In this year "A Treatise on Metamorphism," by C. R. Van Hise, was published as Monograph XLVII, U.S. Geol. Survey. This is a treatise of monumental proportions and is really an attempt to reduce the phenomena of metamorphism to order under the principles of physics and chemistry. Van Hise took seven years in actually preparing this work and he advanced the knowledge of metamorphic rocks and the conditions of their formation very extensively indeed.

The first of a series of papers by R. A. Daly on the "Mechanics of Igneous Intrusion," was published in this year. In this first paper Daly concluded that dykes, sheets, laccolites, bysmaliths, and perhaps a few of the smaller stock-like plutonic bodies are conceived to be due to crustal

displacement ' permitting intrusion ; that marginal assimilation in the preparation of subterranean magma chambers is quite subordinate to magmatic overhead stopping, and that abyssal assimilation, in contrast to marginal (hybabyssal) is responsible for the preparation or notable modifications of magmas whence come, through differentiation, the igneous rocks of the globe.

We thus have the putting forward of Daly's "Overhead Stopping Theory," which has met with fairly general acceptance.

One other publication during the year which deserves special notice is the "Chemical Analyses of Igneous Rocks." by H. S. Washington and published as Prof. Paper 14 U.S. Geol. Survey. This work is a collection of analyses published from 1884-1900 with a critical discussion of the character and use of analyses. The value of this publication to petrographers and chemists has been very great indeed, and although published ten years ago, it continues to be used to a considerable extent.

After the specially rich year in 1903 we find rather leaner times in 1904, 1905, 1906, in the productions of works dealing in a general way with Petrology. "Die Kristallinen Schiefer," by U. Grubenmann, in 1907, was an all important work. The author presented therein a highly systematic treatment of the crystalline schists—something which had been sought after for a considerable time.

Grubenmann explained the characteristics of the crystalline schists and their occurrence in the crust of the earth, according to physico-chemical laws. He made a threefold division of the crust of the earth and these three zones in a general way correspond to Van Hise's two zones.

He gave an exhaustive treatment of the effects in each zone with their determining factors and divided up the rocks into twelve groups. The work was a valuable contribution to our knowledge of metamorphic rocks, in that it summarised the existing knowledge, added new material, put forth a new theory, and set out a classification which although recognised by the author as not a perfect system, has proved of very great value.

In 1908 Dr. H. C. Sorby shortly before his death presented to the Geol. Society of London, a highly important

memoir on the "Application of Quantitative Methods to the Study of Rocks." He applied experimental physics to the study of various sedimentary and metamorphic rocks and gave the results of many years experiment and reflection. Like all scientific writings of this distinguished author, it was marked by a great wealth of experimental detail and showed the great bearing of accurate quantitative methods on the study of these rocks. During this year, R. A. Daly in the "Origin of Augite Andesite and of related Ultra-basic Rocks," strongly supported the early views of Scrope, Darwin and others as to the efficiency of fractional crystallization in the formation of igneous rocks, and stated his belief that the syntectic (assimilation) theory and the fractional crystallization theory were essential and principal elements in the final solution of the genetic problem of the igneous rocks.

The publication of the "Natural History of Igneous Rocks," by Alfred Harker, of the University of Cambridge, in 1909, was of great importance as the work was of an epoch-making nature. Within the few years previous to its publication, a great number of papers, making important contributions to the science of petrology, had been written and a work giving a systematic presentation of the existing knowledge on the subject was needed. Harker's work supplied this want and his lucid treatment of the subject has made this publication a most popular one amongst students of petrology.

Harker believed that a correlation exists between the general geological history and igneous activity of a given region, that igneous action is the result of crustal movements, and that these movements produce magmatic differentiation over continental areas, so that we have magmas of different composition in regions affected by different kinds of crustal movements.

Harker accepts the idea of differentiation and explains petrological provinces as due to differentiation over large areas, and the origin of different types within a given province is also explained as due to differentiation.

Harker, in his final chapter speaks of the American quantitative classification as marking "a retrograde movement, for here the artificial element is applied to the complete exclusion of the natural."

While he does not consider the time yet ripe for a natural classification of igneous rocks, along with Becker he believes that such a classification will be based upon the eutectics occurring in the rocks; that the differentiation of the various rock types from the single parent magma, will be involved, and something similar to the principle of descent used in the classification of animals and plants will be developed. It is interesting to note that closely following on Harker's book, J. P. Iddings, of the University of Chicago, brought out "Igneous Rocks," Vol. I. In many respects the treatment is the same as that of Harker, particularly in those sections dealing with the newer petrology, and Iddings, although differing from Harker on the question of rock classification, agrees with him that the existing systems are unsystematic, unsatisfactory and confusing.

Following up the question of rocks classification, we find Cross, in 1910, in "Natural Classification of Igneous Rocks," giving an excellent summary of the various classifications suggested, and with criticisms of them. It is in the main a defence of the Quantitative Classification originated by himself and three other American petrologists in 1902. He does not subscribe to a classification by eutectics as advocated by Becker and Vogt, owing to its being extremely hypothetical and based on a part of the rock at best. He also reviews the usual fundamental objections to the systematic use of the factors of mineral and textural characters. Cross states: "It appears that a natural classification of igneous rocks, expressing a relation between their most notable chemical and physical properties and the origin of those properties in the geological occurrence is impossible. The natural history of the objects is too complex. The only remaining basis for systematic classification is in the characters of the objects themselves. The chemical, mineral and textural characters of igneous rocks are each gradational as regards several elements. No systematic division can be made except along arbitrary or artificial lines, and in this sense petrographic classification must be unnatural."

Harker, however, believes we have already the germ of a natural system in a classification by eutectics.

On the question of *Alkaline Rocks* to which gradually increasing importance has been attached, Daly furnished during 1910 an interesting hypothesis with regard to their origin. His hypothesis is that most of the alkaline species are formed by the interaction of basaltic magma and limestone.

This view as to the origin of alkaline rocks is still in the hypothetical stage, and as far as Australian representatives of these rocks are concerned, it has not been very favourably received.

In the succeeding year, 1911, Daly in "Magmatic Differentiation in Hawaii," stated as his belief that "all late pre-Cambrian and younger 'Alkaline' rocks are the result of differentiation within primary basaltic magma or within syntectic magmas formed by the solution of solid, generally sedimentary, rock in the primary basalt. The marvellously uniform composition of the basaltic magma issuing from countless fissures in every ocean basin, as in every continental plateau, seems capable of explanation only on the premise that it forms the material of a continuous world-circling substratum. The facts of geology suggest that this substratum was formed by an ancient liquidaion which took place when the globe was molten at the surface." He also holds that the division of igneous rocks into "Atlantic" and "Pacific" groups as suggested by Becke and so strongly advocated by Harker, is not warranted. On this latter question Cross, Iddings, and others are with Daly.

In the "Origin of Igneous Rocks" (1911) by F. Loewinson-Lessing we find a modification of the ideas which were held by Bunsen and Michel Lévy.

The author concludes that there are two original independent magmas and that these predominate in the earth's crust. These two primordial magmas are the granitic and gabbroidal (basaltic) and all other igneous rocks are derivations from them and subordinate to them in their occurrence. All igneous rocks belong to those types: (1) primordial magmas; (2) rocks due to differentiation; (3) rocks produced by a mingling of the two magmas. In addition, all igneous rocks of all geological periods originated principally by the refusion of

the earth's crust, so that we meet in successive periods the same types of rocks.

It is not generally conceded that Loewinson-Lessing was justified in coming to the above conclusions on the available evidence.

"The Methods of Petro-Microscopic Research," by F. E. Wright, which was published by the Carnegie Institution in 1911, was a most important contribution. Wright justly states in petrology: "The quality of our quantitative work is far more important than the quantity of our qualitative work," and his publication is one which certainly makes for increased efficiency in quantitative work.

An interesting paper by L. L. Fermor, in 1912, on the "Systematic Position of the Kodurite Series" in India, discloses a novel idea in the use of garnet as a geological barometer.

Kodurite when classified according to the American classification, gives a *norm* of Orthoclase, Leucite, Apatite, Anorthite, Hedenbergite, Wollastonite, Tephroite, and Magnetite. The *Mode* is Orthoclase, a manganese garnet known as Spandite, and Apatite. Comparison of the specific gravities of the norm and mode of this rock showed that the garnetiferous form (the mode) was of a considerably higher specific gravity and consequently occupied a considerably smaller volume (10 per cent. less) than the non-garnetiferous form (the norm). Fermor, therefore, concluded that Kodurite must have been formed under considerable pressure and that below a certain depth all the ferro-magnesian minerals, such as pyroxene, amphibole, olivine, and biotite with anorthite have arranged themselves as far as possible into garnets, for thereby the maximum reduction in volume and absorption of heat is effected.

Fermor then goes on to suggest that beneath the rocks now known as *plutonic*, there must be a zone of garnetiferous rocks extending downwards in a plastic solid form as far as the presumed metallic core of the earth. For this zone he proposes the term "Infra-Plutonic."

Fermor's publication is very interesting and his conclusions ingenious, but in view of the occurrence of garnet in certain limestone contact-rocks, etc., it would be better perhaps to regard certain other minerals of high specific

gravity and highly endothermic character in their formation under pressure, as being more characteristic of the "infra-plutonic zone" than garnet.

Within the last few months "Igneous Rocks," Vol. II., by J. P. Iddings, has been published. It is interesting to note that the classification of rock-groups is based mainly on the old "qualitative" system and not on the "American Classification" of which Iddings is one of the founders.

#### (CONCLUSION.

An attempt has been made to deal with the various advances made in petrology during the last thirteen years. Owing to the great number of publications bearing on this question, and the difficulty of obtaining them here, it is felt that this review cannot be other than incomplete; but it is hoped that at least the main developments have been chronicled. With regard to the *classifications of igneous rocks* in vogue at present, those based upon (a) mineral (or chemical) composition and (b) texture or geologic mode of occurrence are perhaps the most satisfactory. It is hoped that as our knowledge becomes more complete classifications may be based on the principles of eutectics and the methods of genesis of igneous types.

The main objections to the existing American Classification are that it can not be used without a fairly intimate knowledge of the chemical composition of the rock, and it usually replaces the actual mineral composition by an imaginary mineral composition (the norm). On the other hand it has proved of very great service in revealing chemical characteristics and relationships.

There has been a great deal of controversy on the "*Relations between tectonic and petrographical facies*," as Harker terms it. Harker concludes that "*as regards the younger igneous rocks*, the main alkaline and calcic regions correspond to the areas characterised by the Atlantic and Pacific types of the coastline respectively." and holds that the alkaline rocks are typically associated with subsidence due to radial contraction of the globe, and the calcic rocks with folding due to lateral compression. Cross and others, however, hold that whether the relationship involved, is true or not, it is not responsible for the

chemical differences of the magmatic series ; nor does it appear that the generalization of distribution applies to the older rocks.

Several other authors have expressed their views on the origin of *Alkaline Rocks*. *Becke* suggested that during a gaseous stage of the earth the action of gravity separated the magma into an upper, subalkaline or calcic, layer and a lower, alkaline, layer.

*Jensen* suggested "that alkaline rocks are derived from Archæan saline beds, which by chemical attacks on the adjacent sediments, have given rise to an alkaline magma in the process of metamorphosis. This magma has been squeezed laterally into continental areas and has undergone differentiation, or it has mixed with other magmas, chiefly basic, and then differentiated.

The views of *Harker* and *Daly* have already been given. *C. H. Smyth, Junr.* however, suggests that alkaline rocks are derived from ordinary subalkaline magmas through the agency of mineralisers.

The present position with respect to *Metamorphic rocks* is that two of the fundamental problems of the origin of crystalline schists are now settled, viz., the source of the crystalline rocks and their relation to time. It is generally accepted that they have been developed from both igneous and sedimentary rocks in various periods and not in Archæan times alone as previously supposed. There are two divergent views, however, as to the mode of origin ; (1) that the processes of development are devoid of the agency of igneous rocks : (2) that the agency of igneous rocks is the controlling factor.

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# THE COMPOSITION OF THE OIL OF PRICKLY-PEAR SEED (*Opuntia* spp.)

By **FRANK SMITH, B.Sc., F.I.C.,** and  
**L. A. MESTON.**

(Read before the Royal Society of Queensland, 27th April, 1914.)

## THE SEED.

*OPUNTIA* species, the prickly-pear of America and Australia, bear considerable quantities of fruit of more or less edible quality and containing proportion of seed varying in varieties examined in America from 5 to 9 per cent by weight of the edible pulp. In Queensland varieties examined the seed has been found to comprise 6 to 11 per cent of the fruit.\*

The seeds are distributed throughout the mass of the pulp. They are somewhat disc-shaped and are from one-eighth to three-sixteenths of an inch in diameter. The seed coats are very hard and would be extremely difficult of mastication and digestion by herbivora.

On analysis the seed were found to have the following composition† :—

|                     |    |    |    |    |                 |
|---------------------|----|----|----|----|-----------------|
| Moisture            | .. | .. | .. | .. | 2.47 per cent.  |
| Protein             | .. | .. | .. | .. | 4.65 per cent.  |
| Woody Fibre (König) | .. | .. | .. | .. | 39.77 per cent. |
| Oil                 | .. | .. | .. | .. | 7.12 per cent.  |
| Ash                 | .. | .. | .. | .. | 3.29 per cent.  |
| Other Carbohydrates | .. | .. | .. | .. | 42.70 per cent. |

Other samples of seed were found by the authors to contain from 6-8 per cent. of oil.

\* Report of the Agricultural Chemist for 1912-1913.

† By permission of the Agricultural Chemist.

## THE OIL.

It is difficult to form any estimate of the amount of oil produced by prickly-pear in bearing. It is urged, however, that the oil from the low percentage present in the seed, and on account of the nature and mode of distribution of the latter, can have no commercial value, and the present communication must be viewed merely in the light of a contribution to the chemistry of *opuntia spp.*

For the purpose of investigation a quantity of prickly-pear seed was collected for us by Dr. Jean White, of the Dulacca Prickly Pear Experiment Station, to whom our thanks are due. The oil was removed by petroleum spirit and the solvent removed by evaporation, finally in a brisk stream of carbon dioxide.

The oil is of a clear amber colour, and on examination was found to have the following constants:—

|                                      |         |       |
|--------------------------------------|---------|-------|
| Sp. gr at 15°/15° C. . . . .         | .. .. . | 9242  |
| Refraction (Zeiss at 20° C.) . . . . | .. .. . | 74.8  |
| (Abbe at 20° C.) . . . .             | .. .. . | 1.475 |
| (Oleo at 22°) . . . .                | .. .. . | +26   |
| Acid Value . . . . .                 | .. .. . | 2.8   |
| Saponification Value . . . . .       | .. .. . | 187.5 |
| Iodine Value (Hübl) . . . . .        | .. .. . | 130   |
| Bromine-thermal Value . . . . .      | .. .. . | 24.2  |
| Hehner Value . . . . .               | .. .. . | 94.9  |
| Reichert-Meißl Value . . . . .       | .. .. . | 4     |

## THE FATTY ACIDS.

The mixed fatty acids were found to have an iodine value of 133, and a neutralisation value of 201. The mean molecular weight is 279.

The liquid and solid acids composing the mixed fatty acids were separated by the usual method of taking advantage of the different solubilities of their lead-salts in ether.

The mixed fatty acids consist approximately of (1) 83 per cent liquid acids; (2) 17 per cent. of solid acids.

## THE LIQUID FATTY ACIDS.

The iodine value of the liquid acids was found to be 136, and the mean molecular weight 283. The oxidation products by the alkaline permanganate method of Hazura and Grüssner were examined. Typical crystals of dioxy-stearic acid, melting at 130° C., and crystals of an isomer of sativic acid (tetroxystearic acid), M.Pt. 156-159° C.

#### 14 COMPOSITION OF THE OIL OF PRICKLY-PEAR SEED.

were obtained, but no product that could be identified with linusic acid (hexahydroxystearic acid). Examination of the oil for linolenic esters by the bromination process yielded a negligible amount of hexabromide.

Accordingly the liquid fatty acids of prickly-pear seed oil consist of a mixture of oleic and linoleic acids.

#### THE SOLID FATTY ACIDS.

The solid fatty acids were obtained as a yellowish cake (M.Pt.  $50-53^{\circ}$  C.). The mean molecular weight was determined as 259, hence it was assumed that the solid acids consist almost entirely of palmitic acid. On purification by crystallisation from alcohol fractions with melting points from  $58^{\circ}$  to  $61.5^{\circ}$  C., were obtained. (M.Pt. of palmitic acid:  $62.6^{\circ}$  C.). A small fraction difficultly soluble in alcohol, and separating in white flocks, was also obtained. It melted from  $78^{\circ}$  C. to  $82^{\circ}$  C., was evidently a mixture, and probably consists mainly of lignoceric acid.

#### SUMMARY.

1. The oil of prickly-pear seed is of the class of semi-drying oils.
  2. It is composed of glycerides of oleic, linoleic, and palmitic acids, with probably a small percentage of the glyceride of lignoceric acid.
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# SOME OIL-BEARING SEEDS INDIGENOUS TO QUEENSLAND.

By **FRANK SMITH, B.Sc., F.I.C.,** and  
**L. A. MESTON.**

(Read before the Royal Society of Queensland, 27th April,  
1914.)

## I.—THE SEED OF *MACADAMIA TERNIFOLIA* AND ITS OIL.

*MACADAMIA TERNIFOLIA* (F. v. M.) (N. O. Proteaceae). the Queensland Nut, the nut tree of sub-tropical Eastern Australia, is of common occurrence in the northern brush-forests of New South Wales and the coastal scrubs of Southern Queensland.

It is a tall, evergreen tree, bearing dark green, dense foliage, attaining a height of sixty feet, and is remarkable in that its foliage is rich in cyanogenetic glucoside. Greshoff\* in specimens propagated at Kew, obtained 1 per cent of hydrocyanic acid from the green leaves. One of us (F. Smith) has found .05 per cent. of hydrocyanic acid in leaves collected during the winter months. Petrie† has observed the occurrence of hydrocyanic acid in both varieties distinguished by Maiden, viz.: *M. ternifolia* and *M. ternifolia* var. *integrifolia*. The trees come into bearing during the winter, producing when mature a fair crop. The fruit hangs in racemes, and consists of a two valved coriaceous exocarp enclosing a slightly roughened and shiny endocarp containing a single globular seed.

### THE NUT.

The nut has an average weight of 4.8 grammes and is composed of approximately 75 per cent. shell and 25 per cent. kernel. The shell is hard and brittle and from

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\* Kew Bulletin, No. 10, 1909.

† Proc. Linnean Soc. N.S.W., 1912. Vol 37, Part I., p. 220.

one-sixteenth to one-eighth inch in thickness. The kernel is oily and of pleasant nutty flavour, reminiscent of the chestnut. W. J. Allen (*Agric. Gaz. of N.S.W.*, XVI., 1905, 1028), describes it as one of the best flavoured nuts. finding in New South Wales, where it has been cultivated to a slight extent, a ready market at sixpence to sevenpence per pound. Analysis of the kernel showed it to have the following composition which is compared with that of almonds.

|               |       | Queensland Nut | Almond         |
|---------------|-------|----------------|----------------|
| Mixture       | .. .. | 3.0 per cent.  | 4.8 per cent.  |
| Protein       | .. .. | 8.8 per cent.  | 20.0 per cent. |
| Oil           | .. .. | 66.0 per cent. | 54.9 per cent. |
| Carbohydrates | .. .. | 15.4 per cent. | 17.3 per cent. |
| Crude Fibre   | .. .. | 5.1 per cent.  | 2.0 per cent.  |
| Ash           | .. .. | 1.7 per cent.  | 2.0 per cent.  |

The Queensland Nut contains less protein, but a larger percentage of oil and of fibre than do almond kernels.

The kernels are starch free, contain 5.68 per cent. of non-reducing sugar, and are free from cyanogenetic glucoside.

#### THE OIL.

A quantity of ground kernels were extracted with low boiling point petroleum ether, and the solvent evaporated finally in a stream of warm dry carbon dioxide.

The pale, clear, yellowish oil was found to have the following constants:—

|                              |       |       |           |
|------------------------------|-------|-------|-----------|
| Sp. grav. 15°-15° (°)        | .. .. | .9162 | per cent. |
| (Refraction Zeiss at 20° C.) | .. .. | 61.0  | per cent. |
| (Abbe at 20° C.)             | .. .. | 1.466 | per cent. |
| (Oleo at 22° C.)             | .. .. | — .7  | per cent. |
| Acid Value                   | .. .. | 2.1   | per cent. |
| Saponification Value         | .. .. | 194.5 | per cent. |
| Iodine Value                 | .. .. | 68.0  |           |
| Hehner Value                 | .. .. | 95.9  |           |
| Reichert-Meissl Value        | .. .. | .6    |           |

The oil is of the non-drying class, possessing lower iodine value than the common vegetable edible oils, as almond and olive oils.

THE INSOLUBLE FATTY ACIDS, comprising 95.9 per cent of the oil, were found to have an iodine value of 73.0, and a mean molecular weight of 275.9.

Separation of the liquid and solid acids by the lead-salt-ether method yielded approximately (1) 75 per cent. liquid acids, and (2) 25 per cent. solid acids.

THE LIQUID FATTY ACIDS were found to have a mean molecular weight of 277.0. The iodine value is 84.0. We conclude that the unsaturated acid of Queensland nut oil is wholly oleic acid.

The mean molecular weight and iodine value obtained are, however, considerably lower than the value for pure oleic acid (282 and 90), an indication of the presence of a saturated acid of lower molecular weight.\*

THE SOLID FATTY ACIDS were obtained as a white cake melting at 54° C. They were found to have a mean molecular weight of 273.0. Fractional crystallisation from alcohol gave in order of solubility fractions melting as under.

- (1) 50° C.-55° C., a mixture, containing also proportion of unsaturated acid
- (2) 56° C.-58° C., principally palmitic acid.
- (3) 62° C., pure palmitic acid.
- (4) 69.5° C., pure stearic acid.

From the lithium salts prepared from the fraction of lowest melting point was obtained by appropriate treatment of alcohol a small portion of salt yielding on decomposition with mineral acid crystalline acid melting at 51° C. The melting point of myristic acid (Mol. Wt. 228) is 53° C. Myristic acid is probably present and may also occur in some quantity in the liquid fatty acids prepared by the lead-salt-ether process.

#### SUMMARY.

(1) The nut of *Macadamia ternifolia* compares favourably in composition with that of edible nuts, such as the almond.

(2) It contains 66 per cent. of an edible non-drying oil of low iodine value, and comparatively high content of glyceride of saturated fatty acids.

(3) The oil is composed of glycerides of oleic, palmitic and stearic acids, with some proportion of glyceride of myristic acid.

We desire to acknowledge our indebtedness to the chiefs of the Government Laboratories, Brisbane, for facilities for the carrying out the present and preceding investigation on the composition of prickly-pear seed oil.

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\* The lead-salt-ether method does not affect the absolute separation of unsaturated and saturated acid.

# NOTES ON A PLANT-BEARING COMMON BLACK OPAL FROM TWEED HEADS, N.S.W.

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**By ERNEST W. SKEATS, D.Sc., A.R.C.S., F.G.S.**

(Professor of Geology and Mineralogy, University of  
Melbourne.)

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*(Read before the Royal Society of Queensland, April 27th,  
1914.)*

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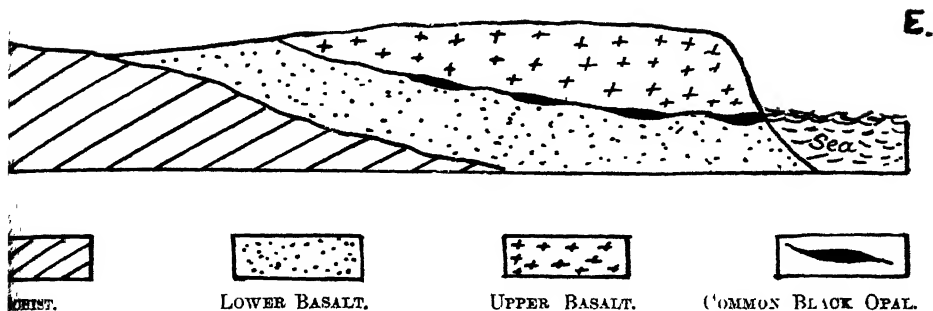
## INTRODUCTION.

ABOUT two years ago, Mr. H. C. Richards, M.Sc., Lecturer in Geology at the University of Queensland, sent me some fragments of a dense black, hard material, which he found associated with the basalt flows of Tweed Heads, New South Wales. Mr. Richards quite naturally, from its appearance and occurrence, described it to me as tachylite, and as forming the glassy selvage to a basic lava flow. I concurred in the identification, but at the time had no occasion to test it critically. Towards the end of the year 1912, however, I had occasion to determine its specific gravity, and that of some tachylites from Victoria and elsewhere. To my surprise I found that it differed entirely in its properties from tachylite.

## GEOLOGICAL OCCURRENCE.

The mode of occurrence of the material will be seen from the sketch section, from information kindly supplied by Mr. Richards. The basalt of Tweed Heads was the subject of a short note by Mr. E. C. Andrews, B.A., in the

Annual Report of the Department of Mines, New South Wales, 1904, pp. 145-146.



SKETCH SECTION showing occurrence of Common Black Opal between the two flows of Basalt at Point Danger. Vertical and Horizontal Scale 200 feet to one inch.

Mr. Andrews described the basalt as of Tertiary age, resting on a denuded surface of (?) Carboniferous rocks nearly at sea level. As basalts of Jura-Trias age are known from adjoining areas, the precise age of the Tweed Heads basalt is, perhaps, to some extent, an open question. Mr. Andrews' description and section show only one flow of basalt. Mr. Richards, however, who is working at the geology of that area, tells me (see section) that two flows occur; that certain depressions probably formed by erosion occur on the surface of the older flow, and that the occurrence of the black material appears to be restricted to these hollows. The later flow sealed them up and they have been recently exposed during quarrying operations. The quarries occur near Point Danger and about 100 yards south of the Queensland border.

#### IDENTIFICATION OF THE MATERIAL.

**SPECIFIC GRAVITY.** Two determinations with a Walker's steel yard gave values of 2.07 and 2.09. The specific gravity of the tachylite from the Merri Creek, near Melbourne, is 2.74, the normal value for a glassy basic rock. The specific gravity of opal ranges from 1.9 to 2.3

#### MICROSCOPIC CHARACTERS.

Five rock sections have been prepared, one of which

was left uncovered, so that the refractive index of the material could be determined against various oils.

The refractive index of the material was found to be very low, lower indeed than that of any known rock.

It was found to have almost the same refractive index as that of chloroform, namely 1.45. The refractive index of tachylite was found to be considerably above 1.53. In thin sections the material is a brownish-red colour, contains, in places, rounded or irregular concretions of pyrite, and is completely isotropic except for minute grains of quartz and possibly felspar embedded in it. It contains no microlites.

#### CHEMICAL CHARACTERS.

Blowpipe tests showed the abundance of silica by the residue or skeleton left in a bead of microcosmic salt: in the closed tube much water was condensed on heating, strong reactions of sulphur were obtained on a silver coin and the residue, after heating, being magnetic, indicated the presence of iron. It will be noticed that all the physical characters, such as specific gravity, refractive index and isotropism, as well as the chemical characters, agree with those of the mineral common opal. The colour and lustre of the material are, however, unusual. It is dense, dull black in colour, with a pitch-like lustre and a notable conchoidal fracture. The occurrence of irregular masses, of nodules of common opal, associated with volcanic rocks, such as trachytes and basalts is, of course, not uncommon, but such as I have seen have been either creamy white, yellow, brown, or greenish in colour. The black opal is interesting also from the fact that it is crowded with fragments of fossil plants.

#### FOSSILIFEROUS CHARACTERS.

Several thin sections of the black opal were made and examined. It was at once noticed that these sections were largely composed of the remains of plants or rather cell structure of vegetable origin. The plant material was very much broken up and disintegrated as a reference to the photomicrographs, Plate I, figs 1 and 2, and Plate II., fig. 1, will show.

Professor Ewart kindly examined the sections for me. He found the material generally too fragmentary for precise determination, but noted the presence of sieve tubes, cork cells, epidermis with cuticle, and in one place, part of the woody tissue of a plant, probably a transverse section of scalariform tracheids. Some of the structures appeared to represent sections of fresh water algæ, others of various plants, including the spore of a fungus, a transverse section of a leaf and, possibly, a section of a small petiole. There was a remarkable paucity of woody tissue represented in the sections.

In one of two places rounded or oval cellular areas occur consisting of silica which now affects polarized light. Their size and the character of their siliceous network suggest that they may be altered radiolaria.

Perhaps the most interesting organism is seen in Plate II, fig. 2. It consists of an oblique section through an appendage of one of the arthropoda and may represent the section of a leg of a fossil spider. The minute hairs projecting from the surface of the appendage are clearly noticeable in the photomicrograph. In New South Wales, Victoria, and elsewhere, some deposits of common opal are found to contain abundant skeletons of the siliceous frustules of the diatomaceae, and close search for diatoms has been made of the thin sections from this deposit, but with entirely negative results.

#### MODE OF FORMATION OF THE DEPOSIT.

Reference to the sketch geological section, fig. 1. shows that the black opal occurs in shallow depressions in the surface of the basaltic flow which has been subsequently covered with a younger flow. It would appear that in the time interval between the two lava flows, erosion of the earlier flow produced slight depressions which became swampy. Plants growing near the depressed areas contributed leaves to the deposit, while fresh water plants grew and accumulated in the swampy depressions. The mechanism by which the material was converted into opal, cannot be clearly pictured, but it is possible that thermal waters stimulated by proximity to an active volcanic centre,

dissolved silica from rocks through which the water passed and that this silica and some of the water was deposited in depressions in the form of common black opal.

### EXPLANATION OF PLATES.

#### PLATE I.

Fig. 1.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales, showing fragments of plants, and an elliptical section possibly radiolarian, in a ground mass of opal.  $\times 14$  diameters, ordinary light.

Fig. 2.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales. Section showing plant remains in matrix of light brown coloured opal.  $\times 120$  diameters, ordinary light.

#### PLATE II.

Fig. 1.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales. The cell structure of a plant adjoins a crack in centre of section.  $\times 120$  diameters, ordinary light.

Fig. 2.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales. In the centre of the field is an oblique section of leg of an arthropod which may be a spider. Surrounding it are plant fragments and concretions of pyrite, in a matrix of brown opal.  $\times 120$  diameters, ordinary light.

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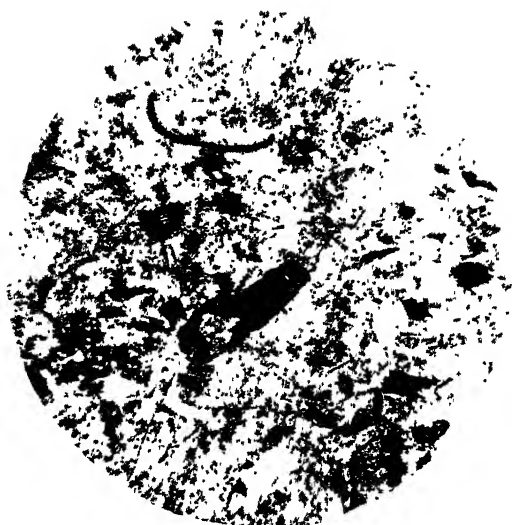


FIG 1.  $\times 14$ .

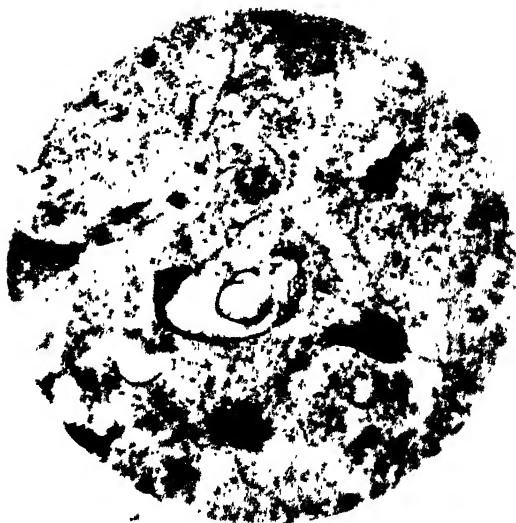


FIG 2.  $\times 120$





FIG 1.  $\times 120$



FIG 2  $\times 120$



# RADIOGENESIS IN EVOLUTION.

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By **HEBER A. LONGMAN.**

(QUEENSLAND MUSEUM).

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*(Read before the Royal Society of Queensland, May 25, 1914)*

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THE somewhat ponderous title heading this paper requires a little explanation. For some time past the writer has been engaged in a kind of stock-taking of such literature on Evolution as has been available for purposes of study. And with this stock-taking, and the putting into shape of a numerous collection of notes, there has seemed to be a personal need for a re-setting of views and an elaboration of old aspects. Probably many persons who are more or less conversant with modern evolutionary literature have been at times puzzled by conflicting theories, and have felt a similar need to attempt to gauge the present position. Thus there may be some utility in putting these notes on record, even though the actual merit of originality be very slight. The Evolution of thirty years ago is not the Evolution of to-day. The impetus given by the work of the great Darwin to many of his contemporaries was responsible for a wealth of literature and research records, much of which is of the greatest value; but with this, there has been a tendency on the part of a few to dogmatic utterances, and also an enthusiasm which sometimes puts theorising far in advance of facts. Both as to the processes and the dynamics of Evolution, assertions have been made which are very inadequate, and, in some cases, quite incorrect in the light of fuller knowledge. Numerous theories, some of which are comparatively modern, have

been established around the facts of variation. Through studying these, Radiogenesis came to mind as a suggestive term for epitomising certain complex phenomena. In some respects it escapes many of the objections which have been raised against the commonly-used Orthogenesis, and it has the advantage, to my mind, of not bearing so definite a teleological interpretation. Hence the title of this paper. And as it is obviously impossible to isolate one phase of Evolution, the writer feels that no apology is needed for touching, even though very casually, on other points.

In some quarters there is a tendency, which is by no means new, to postulate universal laws as the result of a few experiments and observations. In several instances this is doubtless justifiable, but it is becoming more and more apparent that generalisations which may seem to govern certain sets of phenomena may not be arbitrarily applied as laws throughout the realm of nature. In science, as in politics and other schools of life, loyalty to an attitude or a theory tends sometimes to develop a species of dogmatism which, occasionally, creates strenuous controversies.

Many instances may here be given. Let us take first the unceasing discussion of the inheritance of acquired characteristics. Weismann distinguishes acquired characteristics as somatogenic, denoting that such arise only through special influences affecting the body or individual parts of it: in contradistinction to these are blastogenic characteristics which originate solely in the primary constituents of the germ. With Wallace, Ray Lankester, J. Arthur Thomson and others, he holds that acquired characteristics, as so defined, cannot be transmitted to offspring, and so far as negative evidence goes, the position is a strong one. Lankester, it should be noted, believes in the transmittance of what he suggestively terms "educability,"\* and thus his attitude is somewhat qualified. The Neo-Lamarckian school strongly criticises the view that acquired characteristics are not transmitted, and Haeckel firmly supports them here. Dendy has also

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\*Pres. Address, Brit. Association, York, 1906.

pointed out "that it is not difficult to imagine a mechanism by which somatogenic characters may gradually be converted into blastogenic ones, and if this is in any way possible, there is no reason why we should deny the possibility of their inheritance."\* And he associates with his remarks experiments which seem to point conclusively to the inheritance of acquired characters. Although in the great majority of experiments, mutilations are in no way transmitted, yet there are several notable cases which call for comment. Prof. Eugene W. Hilgard, of the University of California, records the case of a cat which sustained a compound fracture of her tail which caused a marked displacement: this peculiarity was noted in some of her offspring, and was aggravated by inbreeding and artificial selection until a race of cats with crooked tails was established.† The ecaudate condition of the famous Manxian felines has somehow to be accounted for, and it is rather difficult to imagine how such a trait could be of a strictly blastogenic origin. Several cases of transmitted deformities (caused by accidents) in human beings have been placed on record, but space forbids their recapitulation here. Apparently, there is no hard and fast criterion as to the susceptibility of organs, or organisms, and, whilst the majority are rigid, some are easily perturbed.

G. Archdall Reid claims that no logical distinction can be made between "acquired" and "inborn" characteristics. He asserts that there are invariably two factors concerned in all development—nature and nurture, and that all the individual inherits is a bundle of potentialities to grow this way and that in response to this stimulus or that. "His nature is the sum of his potentialities; his nurture is the sum of the influences that play on him, and convert his potentialities into actualities. . . . if any character is an acquirement, all characters are acquirements."‡ So states the Chesterton of modern science.

A brief review of literature dealing with the Mendelian theory also shows the incongruity of trying to establish

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\* "Outlines of Evolutionary Biology," p. 404.

† *Ibid.* Cope, "Primary Factors of Organic Evolution," p. 432 (1896).

‡ "Bedrock," January, 1914.

a set of universal laws. Karl Pearson,\* (4. Archdall Reid† and others have pointed out that in certain demonstrable cases, Mendelian laws are contradicted or superseded, and even the acceptance of what modern Mendelians call "independent inheritance," does not solve the question. Elsewhere, I have ventured to summarise my impressions as follow:—"The supposed universality of the Mendelian principle has been largely suggested by focussing attention on certain points and ignoring others. Heredity is more often a complex synthesis than a mosaic of dominants and recessives."‡ It must be added that several writers, amongst whom may be noted E. C. MacDowell,\*\* have endeavoured to interpret blended inheritance on Mendelian lines by "multiple factors." But whatever views are expressed as to the range of the Mendelian laws, there can be no question that some of the most valuable work on heredity during recent years has been the result of investigators who have sought to establish this theory. The accumulation of facts is of the utmost value, even though theories which stimulated the workers who place facts on record may have to be qualified.

The majority of writers do not now dogmatise on the "all-sufficiency" of natural selection. Even the query as to the evolution of structure preceding the evolution of function cannot always be answered in the affirmative. Nowadays, it is not so much a case of putting the views of Darwin against those of Lamarck, but of associating the two, and laying the major stress on natural selection. Instances are given of processes which cannot be wholly explained by natural selection. Speaking on "By-products of Evolution," Dendy,†† points out that natural selection cannot be directly responsible for the minute differences of the spicules of sponges, as these cannot be of importance in the soft tissues of the sponge. Yet these minute spicules exhibit constant specific characters. Possibly, they are subject to an indirect control through being co-related to

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\*"On a Generalized Theory of Alternative Inheritance, with special reference to Mendel's Laws," (1904).

† "Bedrock," July, 1913, p. 232.

‡Pres. Address. Qld. Field Naturalists' Club, 1914.

\*\*Jour. Exper. Zoology, Vol. XVI., No. 2, pp. 177-194, 1914.

††Pres. Address. Quekett Microscopical Club, 1913.

other adaptive characters. Under the principle of natural selection, we may understand that it is an advantage for certain skink and gecko lizards to be able to lose their tails, but can we explain by the same process the power of regenerating them? It is difficult to diagnose the actual origin of an organ, say, the limb of a vertebrate, though once the limbs are there we can conceive a selective process to modifications. We can comprehend that a paddle has been independently evolved in turtles, penguins, ichthyosaurs, seals and whales. Many naturalists assert that minute variations, especially in their initial stages, could not have a survival value. A partial explanation is Darwin's view of co-related variations. But actual facts of variation greatly worried Darwin. As he quaintly expressed himself when writing to Huxley:—"If, as I think, external conditions produce little *direct* effect, what the devil determines each particular variation?"

Writing of some cases of mimicry, R. H. Lock says, "the brain reels before the task of picturing the gradual building-up of such a resemblance by the successive additions of small differences, each one useful to the possessor of it."\*

We naturally look here to the Mutationists for information and help. The principles associated by De Vries with his well-known examples of mutation have recently been subjected to much criticism. Several authorities assert that the mutations noted of the Evening Primrose (*Oenothera lamarckiana*) were in reality due to an ancestral natural hybridism. The Onagraceæ are evidently far more susceptible to hybridising than most other orders. Prof. E. C. Jeffrey, of Harvard University, even goes so far as to say that the mutation theory "may apparently be now relegated to the limbo of discarded hypotheses."† But this is an unwarrantable dictum. Hybridism may be often associated with mutations, but it would be exceedingly difficult to explain all mutations—especially, as we shall see, those noted by palaeontologists—in this way. There has been no mere repetition of "repertoire

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\*"Variation, Heredity and Evolution," p. 57.

†"Science," April 3rd, 1914.

patterns" (to use the term applied by A. Bacot). The actual facts of mutation are too big for that.

Ample evidence has been provided by Bateson,\* that even specific distinctions frequently arise as single variations. Nature leaps as well as creeps. Thus certain meristic variations—or variations in symmetry and the number of organs—may be frequently noted, and many of these cannot develop through intermediate stages. Thus, plants with a four-fold arrangement may jump to a perfectly-developed five-fold form. Bateson also lays stress on what he terms Homœosis, or the variation established when one organ takes on the character of another organ, such as a disc floret of a composite flower appearing in the likeness of a ray. Whatever may be the opinion as to the operation of natural selection on infinitesimal variations, there can be no question as to its inevitable effects, preserving or exterminating, great steps or mutations. The non-viable forms are ruthlessly stamped out, and the fittest survive.

Asa Gray believed that "variation has been led along certain beneficial lines." To this and similar views the name of Orthogenesis has been given. This term implies a guiding principle in variations, suggesting a proceeding along certain definite lines. Plate uses the term ectogenesis, or ectogenetic orthogenesis, for "definitely directed variation." Naturally this view strongly appeals to teleologists, and in certain philosophical quarters, it has been unwarrantably used. It is a very comfortable sentiment and appeals to the popular imagination. But when it comes to an inquiry into actual facts, it falls to the ground. Bateson goes as far as to say that "no fragment of real evidence can be produced in its support."†

There are, of course, other views of Orthogenesis. Thus, Hans Gadow speaks of orthogenetic changes "as predictable in their results as the river which tends to shorten its course to the direct line from its head waters to the sea. That is the river's 'entelechy', and no more due to purpose or design than is the series of improvements

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\*"Materials for the Study of Variation," Macmillan, 1894.

†"Darwin and Modern Science," p. 101.

from the many gill-bearing partitions of a shark to the fewer and more highly-finished comb-shaped gills of a Telostean fish ”\*

Kellogg writes of believers in a kind of Orthogenesis, implying that “organic evolution has been, and is now, ruled by unknown inner forces inherent in organisms. and has been independent of the influence of the outer world. The lines of evolution are immanent, unchangeable, and ever slowly stretch towards some ideal goal.”† Such a belief savours more of abstract philosophy than of science.

J. M. Baldwin, recognising the difficulties associated with the term Orthogenesis, used the term Orthoplasia,‡ thus suggesting a freer play of the laws of natural selection. But this term is inadequate to typify the facts. The phenomena of variation are wider than any of the theories.

Very concisely I have endeavoured to enumerate a number of other standpoints. Hans Driesch formulated a view which suggests a kind of “directive soul” for organisms, an “entelechy” operating on its course of variations. Samuel Butler and Semon propounded a theory of organic memory, and the latter opines that the results of stimuli can never be wholly lost. The quintessence of Weismannism is a struggle between hereditary forces, with nutrition as a contributory factor. De Vries looks upon nutrition as a dynamic of individual variability and mutation, and here may be gathered much evidence from many practical experimenters. Of intense interest are the researches of Loeb and Poulton who have recorded many experiments—the former chiefly with marine invertebrates and the latter mostly with the pupal stages of insects—which apparently demonstrate that variation, and even the life form itself mechanically react to chemical and other external processes. The experiments of C. W. Beebe, New York Zoological Society, are illuminating in the same respect with relation to Passerine birds. He shows that alterations in temperature and food are accompanied by changes in plumage and in the moulting season, and that

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\*Pres. Ad. Zool. Sect. Brit. Assn., 1913.

†“Darwinism To-day,” p. 278.

‡Quoted by Osborn. Op. cit. post.

the inherited succession of plumage may be interrupted at the will of the experimenter.\* In the summary of the Horn Expedition, Baldwin Spencer notes the varying sizes of mature specimens of the smaller marsupials, especially *Phascogale cristicauda*, found in the central district of Australia. In good seasons large specimens were found, but during the series of bad seasons and dearth of food, the animals secured were much smaller.† Do we not see here a diminutive form in process of evolution? If certain forms are dwarfed through partial starvation, the result is very obvious in the life of the individual, and this may be intensified in offspring subjected to the same conditions, whether the principle of natural selection operate or not. Perhaps such diminutive forms as the Shetland cattle and ponies may here be given as an island parallel to arid conditions in continental areas. To take a wider outlook, there is indubitable evidence that the known history of the Marsupialia in Australia is mainly a record of the survival of relatively small forms, whilst the larger monotremes, wombats, kangaroos and polyprotodonts, to say nothing of the giant *Diprotodon* and *Nototherium*, have died out. This has been a concomitant of the gradual change from more exuberant conditions of the Pleistocene period.

In contradistinction to Loeb, the most distinguished representative of the vitalist school—Bergson, claims that variations cannot be explained as mere mechanical response to stimuli, but spring from an internal creative impulse. Here may be added Ray Lankester's timely reminder that "variation is a common attribute of many natural substances of which living matter is only one."‡ Even Astronomy furnishes an example, for has not Saturn a satellite which goes round "the wrong way"!

(Of exceptional interest is the work done by Karl Pearson, who in his "Grammar of Science" has accumulated a multitude of observations on heredity and variation largely with reference to the problems of humanity itself.

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\*"Zoologica," Feb., 1914.

†Horn Expedition, Pl. I., p. 143.

‡"Science from an Easy Chair," Ser. I., p. 35.

In connection with these observations the term "Biometrics" is coming into popular usage.

Henry F. Osborn, a well-known American writer, claims that there are four inseparable and inter-associated factors of evolution, viz.: Heredity, Ontogeny, Environment and Selection. The working of these four factors he elaborates under the term Tetraplasy. He defines Ontogeny as the expression of heredity reaching to and modified by the conditions of life, of environment and of selection, and summarises no less than 24 ontogenic processes.\* Here we have a much wider outlook and one which is more in harmony with the complex phenomena of variations. Osborn's work cannot be neglected by any careful student of Heredity.

Thomson and Geddes have given us an attractive theory of evolutionary processes which owes much of its charm to the poetic feeling and literary style of the authors. They write of definite variations which branch dichotomously. "forms thrown from the rhythmic oscillation of the loom of life," chiefly as the result of vegetative and reproductive forces. Nature to them is no "gladiators' show" (to use Huxley's term). They view variations as definite rather than indefinite, "with progress essentially through the subordination of individual struggle and development to species-maintaining ends. The ideal of evolution is thus no gladiators' show, but an Eden: and though competition can never be wholly eliminated—the line of progress is thus no straight line, but at most an asymptote—it is much for our natural history to see no longer struggle, but love as 'creation's final law'."

But with all due regard to the prestige of these able writers, may we not see here the result of theorising too much on physiological analyses of present day organisms, instead of endeavouring to obtain a comprehensive view of the march of life from the past to the present. Does not modern palaeontology suggest that variations have branched not definitely and simply but polychotomously? The key to the process has been Radiogenesis, and not Orthogenesis, even though the latter term be much qualified.

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\*Journ. Acad. Nat. Sci. Phil. 2nd Ser. Vol. XV, 1912.

And it would surely be hypocritical to deny that nature manifests its "gladiators' shows", even though the amphitheatre be an Eden.

We have now on record a multitude of examples of a wide range of radial variation in many groups. For the purposes of this paper but two instances are given. In the Hawaiian Islands the song birds which constitute the family Drepanidæ show remarkable diversity. Each island has its group of species, and some of these are confined to a small district, "to a single kind of thicket, or a single species of tree." To quote Jordan and Kellogg. "In this family are about forty species of birds all much alike as to general structure, but diverging amazingly from each other in the form of the bill, with, also, striking differences in the colour of the plumage. . . . we find Drepanidæ in Hawaii fitted to almost every kind of life for which a song bird in the tropics may possibly become adapted."\* For the second example we may quote, from the same authorities, the land snails of Oahu, (Hawaii.) "According to Mr. Gulick, the land snails of the wooded portion of Oahu have become split up into 175 species represented by 700 or 800 varieties. He frequently finds a genus represented in several successive valleys by allied species, sometimes feeding on the same and similar plants. In every case, the valleys that are nearest each other furnish the most nearly allied forms, and a full set of the varieties of each species presents a minute gradation between the more divergent types found in the more widely separated localities."† The establishment of these variations, in both birds and snails, is almost certainly due to isolation, but the actual variability itself may be well expressed by a principle of Radiogenesis.

It is now an axiom that similar structures have been independently developed in different groups. "The eye," says Hans Gadow. "has been invented dozens of times."‡ Walter Stapley writes: "It seems a process of narrow reasoning which admits the origin of new species, but refuses to admit that new structures may be evolved. The denial

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\*" Evolution and Animal Life," p. 124.

†Op. cit., p. 123.

‡Op. cit.

of the appearance of new structures seems to be the basis of the theory of atavism."\* Stapley illustrates this stand point by demonstrating that where neck ribs have degenerated into vestiges in certain cases they have re-evolved in response to a different impulse. Doubtless many structures once traced to atavistic influences are in reality new. Here we may appropriately note that Hans Gadow in his presidential address to the Zoological Section of the British Association last year gave a most useful summary of both facts and nomenclature associated with the old terms of convergence and parallelism.

Then, too, there are evidences of the exuberance of life for which we need seek no causal explanation. Darwin was content to look upon certain manifestations as being incidental and unimportant. In the "Descent of Man"† he says: "Bearing in mind how many substances closely analogous to natural organic compounds have been recently formed by chemists, and which exhibit the most splendid colours, it would have been a strange fact if substances similarly coloured had not often originated, independently if any useful end thus gained, in the complex laboratory of living things." Bateson says,‡ "I feel sure that we shall be rightly interpreting the facts of nature if we cease to expect to find purposefulness wherever we meet with definite structures or patterns." Starr Jordan, when writing of the bright colours of coral fishes, says that these cannot be explained on protective lines, and that nature seems to revel in bright colours when it is safe for her creatures to have them. Dendy instances the sculptured patterns on the calcareous shells of Foraminifera as characters which are of no adaptive value and which might be equally well replaced by alternative characters. These patterns are of a specific nature, but he cogently asks, "Does one pattern help a unicellular foraminiferan or radiolarian more than another in the struggle for existence?"\*\*\* The theories of warning, protective, adaptive and sexual colouration and recognition marks account for a large proportion

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\*P10 Roy. Soc., Vic., XXV., Pl. I., Aug., 1912.

†2nd Edition, p. 262.

‡"Darwin and Modern Science," p. 100.

\*\*\*"Outlines of Evolutionary Biology," p. 419

of chromatic characteristics, but many critics are demonstrating that these theories have been pushed to absurd lengths. Here I may mention the work of Dewar and Finn\* and of Punnett. The very perfection of some mimetic resemblances in butterflies, the simulation of fungoid growths on a leaf pattern, for instance, is so unnecessary and elaborate that it is difficult to account for on utilitarian lines. There is a rich diversity of pattern and colour which is a manifestation of radiogenetic variation. In passing we may note that such cases cannot be claimed as evidence by the exponents of Vitalism. Radiogenesis, when compared with Orthogenesis, is at variance with any teleological conception. But I must not be tempted to dwell on this point, more especially as I have dealt with it elsewhere.†

The striking divergence of opinions among authorities shows the difficulties attending the present study of variation and heredity. And here it seems to me that more light can sometimes be shown by a study of the past than by an analysis of the present. May we not learn more, both of laws and of dynamics, by collating evidence as to the paths variations have gone, rather than by endeavouring to trace the tracks they are taking? It has been aptly stated that man's outlook on the processes of nature during his life-time is comparable to the momentary illumination of a landscape during a lightning flash in a midnight storm. It is therefore not to be wondered at, keen though our observers be, that investigations in laboratories and experiment grounds during the last half century have not satisfactorily elucidated what nature has accumulated during long geological periods.

Palaeontology is one of the youngest of sciences, but it has not escaped many initial errors. Nor are we here referring to such obviously incorrect views as the "Catastrophism" of Cuvier. The principle of some of the older workers was to judge the complete biota of past geological periods merely as preparatory stages for the life of to-day. The assurance with which Haeckel drew up genealogical trees (tentatively, it is true) startled even

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\*"The Making of Species," John Lane, 1909.

†"The Religion of a Naturalist," p. 38. (R.P.A.—Watts & Co.)

Darwin. Endeavours were made to read into all extinct forms some lineal association with modern organisms. This resulted from a very natural idea that our modern world with its fauna and flora was in reality the *summum bonum* of all life and that the processes of nature, without exception, were so arranged as to establish a suitable environment for man. Now we have somewhat to amend this view. We cannot always judge the past by the present. In each era life has radiated out apparently to the full gamut of potentiality. There have been rich developments of certain groups in different periods. One may note such well-known instances as the abundance of Trilobites in the Cambrian, Dipnoid fish in the Devonian, *Nautiloidea* in the Silurian and *Ammonoidea* in the Trias. Systematists have already noted about 5000 species of Ammonites, and so abundant is material that the evolution of the group from its origin to its extinction has been well worked out. Some of the forms were very highly specialised, and the maze of their sutures—often beautifully shown in our Queensland Cretaceous specimens—demonstrates an organism of great complexity. The protean development of marine, land and air forms of reptilian life in Mesozoic times exhausts the most superlative of adjectives when description is attempted. The great majority of these forms were lateral offshoots from the main stream of life, and they have no lineal relationship with the animals of to-day. Many were apparently the victims of over-specialisation, of hypertrophy. Here the multitude of diverse forms gives evidence of radial evolution, of wild exuberance of life flourishing for a time until cut short by the iron laws of natural selection. And in the succeeding age of mammals we find a similar story. Tertiary times show a rich development of mammalian life, including gigantic types, and many of these were not potential for the future. Certain forms came upon the stage of existence, played but a brief part, geologically speaking, and then disappeared. These were the derelicts of nature, the failures in the struggle of life. Yet they were no weaklings, and some carried a bulk of bone which is astounding. They were not lacking in virility, but in plasticity. Other forms were forerunners of the fauna of to-day; their very life-blood runs in present-

day species. We know the lineage of the horse, the elephant, the camel and several other groups. Although there are lacunæ in our palaeontological knowledge we can never hope to fill, some strata have yielded surprisingly complete evidence on the evolution of certain groups.

Still more familiar examples to Australasian workers of radial evolution may be noted. In New Zealand wingless avian forms developed on such lines as though they had striven to take the place of the missing land mammals. These existed until recent times, and their pigmy cousins (the Kiwis) are with us still. In Australia among the living and extinct marsupial forms, the majority of the types found in the true placentals have their analogues. We have, or have had, large and small herbivorous, insectivorous and carnivorous forms, and there are diverse examples of semi-subterranean, burrowing, arboreal, parachuting and saltatorial habits. Divergencies may be illustrated by the dental characteristics, say, of *Thylacoleo*, *Sarcophilus*, *Hypsiprymnus*, *Diprotodon*, *Phascodomys*, *Myrmecobius* and *Notoryctes*. Such striking distinctions in an order in one region may be generalised as due to a principle of Radiogenesis. These marsupials have not been stationary since Tertiary times: they show processes of rapid evolution, and in some cases we have evidence of degeneracy: nor can we translate the characteristics of many of our extinct forms in terms of lineal relationship with the life of to-day, and they add further complexity to our fauna.

Thus the life of the past makes multifold the variation of to-day. Perhaps the crux of the whole problem may be expressed in the two questions put by Osborn, the American palaeontologist.\* "Is it true that the greater number of new or *germinal* characters which appear are *orderly and according to some entirely unknown law* of adaptation? Or is it true that the greater number of new characters are accidental, disorderly, fortuitous, adaptive or inadaptive, fitted or unfitted, and that order comes out of chaos by the selection of those which happen to be fit!" —natural selection mimicking design, as Balfour puts it.

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\*Jour. Acad. Nat. Sci., Phil., Ser. 2, Vol. XV., 1912, p. 301.

But must these questions be arbitrarily put as alternatives? To vary the phrasing, was Samuel Butler—"that clever but contradictory writer," as Lankester calls him—justified in opposing "Luck to Cunning?" Are not both "Luck" and "Cunning" factors in evolutionary processes?

Theories of variation are incomplete unless they provide for the facts of momentum, or excessive growth, for the tendencies to develop colossal structures such as the huge dorsal plates of the Stegosaur, the teeth of the sabre tiger, the antlers of the Irish elk, the tusks of the mammoth, and the horns of the weird *Arsinoitherium*. Theories have to be elastic enough to allow for teratological phenomena, for malformations and abnormalities, for such growths as are associated under the term Dysteleology. Some examples, which might be noted here, so far as the individual is concerned, exhibit no principle of radiogenesis, but rather one of orthogenesis almost "run mad," to our human view, for some of the structures associated with extinct animals appear to have been carried to a degree far in excess of utility.

Zittel, in the introduction to his well-known text-book of Palaeontology, says: "Evolution in the organic world has not advanced in a simple, straight-forward direction, but in an exceedingly complicated and circuitous." Palaeobotanists also tell us that the development of plants has sometimes been accompanied by a progress from the complex to the simple, which is almost a retrogression.\* Such processes are not, of course, the general rule, but they are notable exceptions. D. H. Scott notes that in the evolution of plants there have been long periods of stability—"that times of comparative constancy have alternated with intervals of apparently rapid change."

In the "Natural History of Plants" (Kerner, translated by Oliver,) which is one of the most authoritative botanical works, the difficulties of theories of progressive development are emphasised. The impossibility is stated of estimating any order of plants as being the most highly

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\*Scott - "Evolution of Plants," p. 17.

developed. Thus certain sea-weeds (*Macrocystis*) are as large as forest trees, and the cell structure of Diatoms and Desmids "must be regarded as more highly organized than many small annual composites" The author asks which group has reached the highest point—"is it the Aristolochiaceæ, Cannaceæ, Magnoliaceæ, the Orchids, the Composites, the Ranunculaceæ, the Papilionaceæ or the Pomegranates ? . . . Like the theory of adaptability, that of progressive transformations from inherent forces fails to give us a reasonable explanation of the variations which plants have undergone in process of time."\*

(Ope used the term "expression-point" for the fixed and definite acquisition of some new character which has marked a new advance in the gradation of life. And Smith Woodward adds that this "seems to have rendered possible, or, at least, been an essential accompaniment of a fresh outburst of developmental energy." The same writer says: "Palaeontology, indeed, is clearly in favour of the theory of discontinuous mutation, or advance by sudden changes, which has lately received so much support from the botanical experiments of H. de Vries."†

Dendy in his lucid work, "Outlines of Evolutionary Biology,"‡ states that the branching of the phylogenetic tree, representing the evolution of life, has been monopodial rather than dichotomous or polychotomous. But here we think there is a great deal of opposing evidence. Latterly there has been accumulated palaeontological material which points to a multiple origin of many types. It seems not unlikely that even man himself arose radially from a number of mutable anthropoid forms. The authority of Arthur Keith\*\* may be quoted to the effect that certain fossil crania, amongst which may be included the famous Piltdown skull, *Eoanthropus Dawsoni*, and Neanderthal types, represent distinct and extinct types of humanity and not forms ancestral to modern man. And there is no arbitrary reason why these distinct genera and species

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\*Vol. II., p. 599.

†Ann. & Mag. of Nat. His., Vol. 18, 1906, p. 316.

‡Op. cit., p. 230.

\*\*"Bedrock," January, 1914. (In the same journal, April, 1914, G. Elliot Smith strongly dissents from this view).

should be traced back to one isolated mutation ; in fact, many observations on the origin of mutations and variations to-day are opposed to that view, for such often arise in profusion and not in isolation.

Have we not undoubted evidence that the paths of variation in the past, even under the iron restriction of natural selection, have been radial ? It seems to me that radial diagrams, such as those used by H. W. Conn, represent the courses of evolution more accurately than simple dichotomous branching ; and, to be logical, one must assume that such diagrams should be primarily radial, and secondarily polychotomous. Such diagrams, although necessarily tentative, are surely an appropriate expression of the labyrinthine processes of evolution.

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# CACTE. OR PRICKLY PEARS

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By **JOHN SHIRLEY, D.Sc., and C. A. LAMBERT.**

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(Read before the Royal Society of Queensland, June 29th, 1914)

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## 1.—INTRODUCTORY.

No plant of the Cactus family is a native of Australia: their native home is America: they inhabit the drier districts of the S.W. United States, Mexico, the West Indies, Central America, and the warmer parts of South America. Just as the name of Mr. Walter Hill is often held up for scorn as the introducer of the so-called *Sida acuta* into Queensland, when he merely carried it from one part of Queensland to another, recognising its possibilities as a fibre plant, so various persons have been given the credit, or discredit, of introducing different Cacti into Australia. Mr. J. H. Maiden,\* Government Botanist of New South Wales, a most diligent and methodical investigator of plants of this family, has shown that their introduction to Australia was due to Governor Phillip, and that the first cuttings were brought out by the fleet that founded Sydney, and took possession of Australia on behalf of the Empire.

## 2.—PECULIARITIES OF THE CACTUS FAMILY.

The ideal country for the establishment of the Cacti, known to us as Prickly Pears, is one in which a rainy season

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\*A preliminary Study of the Prickly Pears naturalised in New South Wales: Department of Agriculture, N.S.W., Miscellaneous Publication, No. 253



PLATE III.

FIGURE 1.—Transverse section of the cladode of *Opuntia aurantiaca*, Gillies.

From the outer surface inwards, the following tissues are seen:—

- I. Epidermis of single layer of cells.
- II. Single layer containing crystals of oxalate of lime.
- III. Dermis or collenchyma of five rows of cells.
- IV. Palisade tissue.
- V. On the left a stomatal tube.

FIGURE 2—Epidermis of *Opuntia aurantiaca*, Gillies.

Four stomata are shown, and numerous sphere-crystals of oxalate of lime.



FIG 1.

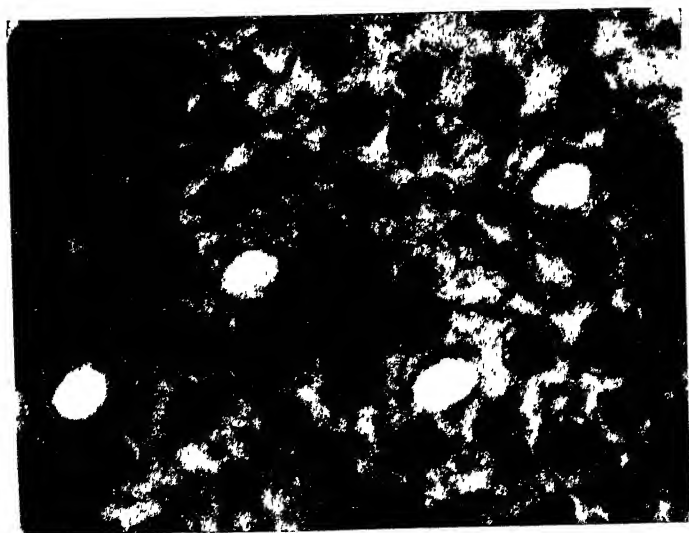


PLATE IV.

FIGURE 1—Tangential section of developing spine of *Opuntia inermis*, D.C.

FIGURE 2—Epidermis of *Opuntia inermis*, D.C., showing numerous spherocrystals of oxalate of lime.

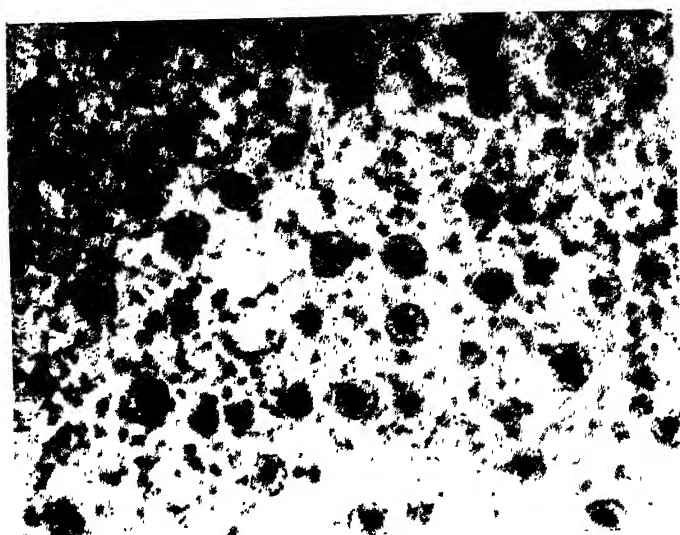


Fig. 2.



Fig. 1.

## PLATE V

FIGURE 1—Transverse section of cladode of *Opuntia inermis*, DC., showing from the outer layer inwards—

- I. The epidermis of one layer of cells.
- II. Single layer containing crystals of oxalate of lime.
- III. Dermis or collenchyma of five layers of cells.
- IV. Palisade parenchyma.
- V. On the right centre a stomatal tube
- VI. Below it a mass of crystal sand.

FIGURE 2—Epidermis of *Cereus grandiflorus*, Haw., showing seven stomata.

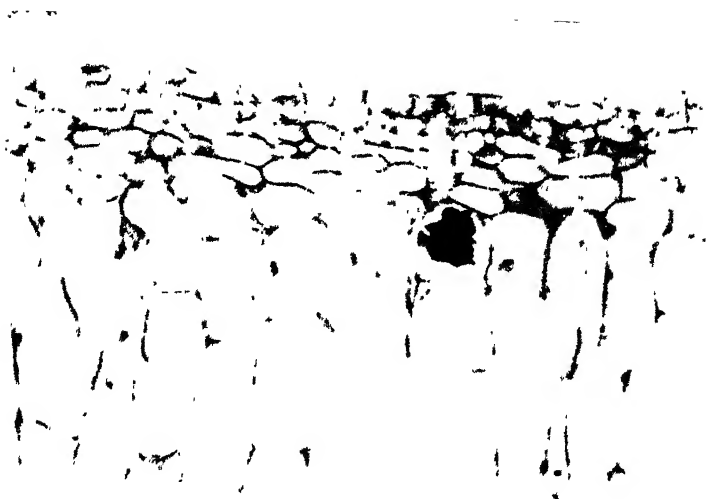


FIG 1.

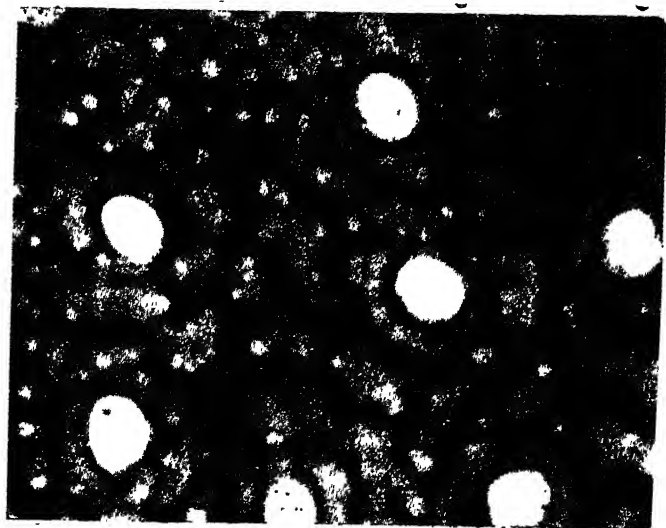


FIG 2

PLATE VI.

FIGURE 1—Transverse section of cladode of *Cereus grandiflorus*, Haw., showing from the outer surface inwards—

- I. Epidermis with uneven cuticularisation.
- II. Dermis or collenchyma of four layers of cells with greatly strengthened cell-walls.
- III. Palisade parenchyma.
- IV. In the centre a stomatal tube.

FIGURE 2—Transverse section through the flower-bud of *Peireskia aculeata*, Mill., showing parts of several petals and sepals.



FIG. 1.



FIG. 2.

PLATE VII.

FIGURE 1--Vascular bundle of *Echinocactus Eysenii*, Linc., viewed by ordinary light

FIGURE 2—The same as viewed by polarised light, revealing starch grains in the bast parenchyma.



FIG. 1.

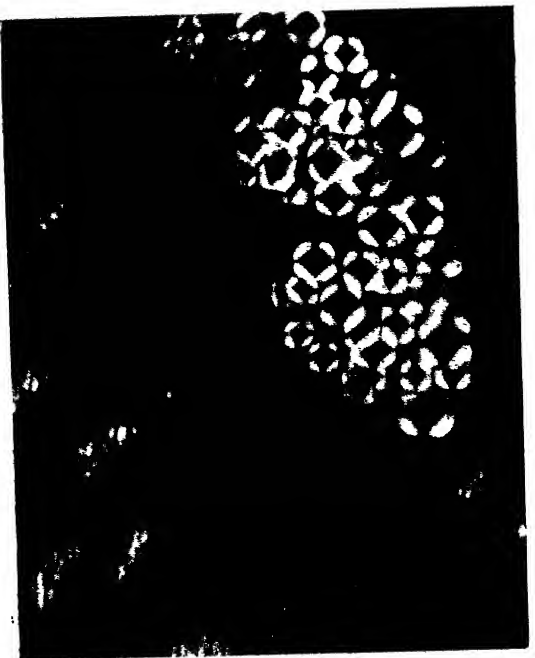


FIG. 2.



alternates with periods of dry weather, or even of drought, in which there is little trouble from frost : where there is a depth of soil not less than ten inches in thickness, containing a fair percentage of lime ; and where there is a rainfall for the year of at least ten to twelve inches. All these conditions are provided in the greater part of Queensland and Northern N.S. Wales, hence the rapidity with which introduced plants of this family have spread in these States, as well as in countries providing like conditions—S. India, Ceylon, S. Africa, etc.

An introduced plant in a new country has many advantages over native species. It has left its natural enemies behind, and the insects or mammals that are likely to prey upon it are some time before they discover its uses. It therefore thrives and spreads at this stage more readily than in its native haunts. But the Cacti are specially adapted to ward off enemies. Those that are proving pests in Australia have no true leaves ; the stems are flattened, they retain their epidermis, and are green because their cells are furnished with chlorophyll. The true leaves fall off when young, or are changed into spines. It is much more difficult for noxious insects to damage these cladodes, as the flattened stems are called, than to damage an ordinary foliage leaf. Again, at each node, the point from which leaves or flowers spring, instead of leaves or branches, there are sharp spines, in some species 2-3 inches long, and a tuft of bristles or spinules, often furnished with a most formidable clothing of recurved barbs. These defences serve to keep away most of the grazing mammals. On the grazing farms in Texas, the spines are burnt off by means of flames from small acetylene tanks, borne by employees, and the cattle following the workmen feed upon the disarmed cactus.

As a protection against insects, all species yet examined by the authors of this paper are found to have the cells of some portion of the cladode, or in *Peireskia* of the leaf, armed with crystals of oxalate of lime. In *Opuntia inermis*, D.C., the pest pear of Queensland and New South Wales, and *Opuntia aurantiaca*, Gillies established near Warwick, sphere-crystals form an almost continuous

layer, occupying cells lying directly below the epidermis; other needle-shaped crystals of similar or nearly similar composition are to be found in the cell walls of cortical and deeper layers. The vascular strands are also protected on each side, in many species, by other cells filled with sphaeroraphides. Not only are these crystals a kind of protective armour whose sharp points repel the attacks of insect larvæ\*, of coccids, and other soft-bodied creatures, but the cells containing them seem to be avoided by fungi. In making sections of Cacti so protected, each of the two workers found the knives of their microtomes rapidly blunted, and far more difficulty was experienced in obtaining good sections than with any other vegetable tissue. The needle-shaped crystals, true raphides, are very abundant in our grass trees, and make the sectioning of parts of those plants difficult: but the sphere-crystals or sphaeroraphides of the cortex of *Opuntia* offer far more difficulty.

### 3.—PLANTS NATURALISED IN QUEENSLAND.

Omitting plants like the night-blooming *Cereus*, *C. grandiflorus*, which may occasionally be seen climbing over scrub or forest trees near a deserted homestead, the Barbadoes Gooseberry, *Peireskia aculeata*, already mentioned, and species of *Rhipsalis*, *Echinocactus*, *Melocactus*, and *Mammillaria* seen in our bush-houses, the introduced species that have fully established themselves in our State belong to two genera, *Nopalea* and *Opuntia*. In *Nopalea* the essential organs, the stamens and pistil, protrude from the petals, which press closely around them, or are connivent, as the botanist expresses it. In *Opuntia* the essential organs are shorter than the petals, which encircle them at a distance, together forming a funnel-shaped corolla.

The following table is a list of species likely to spread with some of the localities from which they have been reported :—

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\*Evans' Botany, p. 93.

SPECIES OF *Opuntia* AND *Nopalea* NATURALISED IN QUEENSLAND.

| Species.                              | Habitat.  |
|---------------------------------------|---|
| <i>Opuntia aurantiaca</i> , Gill. .   | Warwick, common about the banks of the Condamine, near the town.  |
| „ <i>Dillenii</i> , Haw. ..           | Brisbane. Gayndah, Rockhampton.   |
| „ <i>fiens-indica</i> , Mill.         | Occasionally seen near deserted stations, etc., but usually reports of the presence of this pear prove to refer to <i>O. tomentosa</i> .  |
| „ <i>inermis</i> , D.C. ..            | This is the pest pear, said by Mr. Temple (Clerk. in his booklet, "The Prickly Pear Problem," to cover 30 million acres in Queensland alone, and to be spreading at the rate of one million acres a year. |
| „ <i>monacantha</i> , Haw.            | On both sides the Suttor River.   |
| „ <i>nigricans</i> , Haw. ..          | Yelarbon, S.W. Queensland.  |
| „ <i>tomentosa</i> , Salm-Dyck        | Dulacca. Gracemere, Helidon, Warra, etc.  |
| <i>Nopalea corcinellifera</i> , Mill. | Ennetabl.   |
| „ <i>dejecta</i> , Salm-Dyck.         | Rockhampton district.   |

## 4.—HISTOLOGICAL NOTES

Besides specimens of *Opuntia inermis*, *O. aurantiaca*, and *O. monacantha*, by the kindness of Mr. J. F. Bailey, Director, Botanic Gardens, Brisbane, we obtained specimens of *Cereus grandiflorus*, Haw., *Echinocactus Eyresii*, Luce., *Peireskia aculeata*, Mill., and *Rhipsalis salicornioides*, D.C. These were all sectioned, and examined under the microscope, the main study being centred on the pest species.

I.—*Opuntia aurantiaca*, Gillies.

This species is so well armed with a close layer of subcutaneous cells containing sphere-crystals of calcium oxalate, as to be likely to defy all insect pests, and to spread rapidly. It is provided with small, elongated-ovate joints, and is easily recognisable by its reddish epidermis, especially noticeable in young growth. See Plate III., Fig. 1. The epidermal cells are from  $\frac{1}{80}$  to  $\frac{1}{75}$  mm. in length, by one-half those dimensions in breadth. The outer wall is thickened with a deposit of cutin until it equals one-third the whole width of the cell, or  $\frac{1}{380}$  to  $\frac{1}{450}$  mm.

The dermal layer is formed of five rows of cells, those of the first layer lying immediately below the epidermis,

contain the spheroraphides of oxalate of lime, and show like silver stars under polarised light. The cells of the dermis increase in size in each successive and deeper layer. In some places there is a sixth layer, whose cells deviate from the usual brick-shaped form and are cut off at the corners so as to be almost prismatic. This change from the brick-shaped to the prismatic form can be gradually traced from the surface inwards. The dermal cells are very thick walled, and the cell walls take up the stains as freely almost as the nuclei of the cells.

Since the flattened joints of *Opuntia* have to perform the functions both of leaf and stem, it is not surprising to find the cortical tissue playing the part, and copying the structure of the outer mesophyll of foliage leaves, and the same term, palisade parenchyma, may be applied to it. This tissue is found immediately below the dermis, on each side of the stem, with a depth of about 10 rows of oblong cells, set with the long axis at right angles to the epidermis. An average cell is about  $\frac{1}{12}$  mm. long by about half that breadth. The outer palisade cells are supplied with numerous chloroplasts, but these are replaced by leucoplasts in the inner layers. When viewed in direct sunlight, or in polarised light, the walls of these cells were seen to contain minute crystals of acicular form. Some few cells of the outer or sub-dermal rows contained masses of yellow-brown crystals, the so-called crystal sand. The spherocrystals were  $\frac{1}{60}$  mm. in diameter. See Plate III., Fig. 1., and Fig. 2.

## II — *Opuntia inermis*, D.C.

The same general structure is seen in this as in *O. aurantiaca*, but the sphere-crystals though quite as numerous, and occupying the same sub-epidermal position, are smaller, varying from  $\frac{1}{75}$  to  $\frac{1}{90}$  mm. The walls of the palisade cells are studded with smaller and isolated crystals. Tawny masses of crystal sand were also evident in this species. Plate IV., Figs. 1 and 2.

In a transverse section of a joint or flattened stem, the vascular bundles are found at the base of each mass of palisade parenchyma. The wood vessels are few in

number\*, and usually showed spiral strengthening layers. The bast vessels form a larger mass of tissue, and in a few of the vascular bundles appeared to be bi-collateral.

In the palisade parenchyma, and also in the medullary or water-storing tissue of the stele, are numerous air-cavities. The inner walls of these cavities take up some stains readily, and, under a low power, look like dark blotches, but with proper focussing, and with a high power, the outlines of the cells lining them can be revealed. In a rather thick section, stained with hæmatoxylin, there are signs of tubes connecting the air cells of the medulla with those of the two layers of parenchyma, and in all cases there are passages from the stomata to the air-spaces. The breathing spaces are  $\frac{1}{6}$  to  $\frac{1}{10}$  mm. in greatest diameter, and are usually globular or elliptical in shape. Plate V., Fig. 1.

On each side of the vascular bundles the sphere-crystals are thickly scattered: they are sparingly seen in the walls of the medullary tissue or aqueous tissue as it has been termed, because its cells store up water after every fall of rain.†

### III.—*Opuntia monacantha*. Haw.

An examination of stems of this pear make it easy to understand why the cochineal insect can damage this species, while its attacks have no effect on such plants as *O. inermis* and *O. aurantiaca*. The armour of sphere-crystals is almost absent from the subepidermal layer of the dermis, and though there are traces of small oxalate of lime crystals in the walls of the palisade cells, they are only seen with high powers, and are not by any means too evident even then, though sought for with the aid of polarised light. In all other respects the histology agrees with that reported for the species already mentioned.

### IV.—*Peireskia aculeata*. Mill.

The Barbadoes Gooseberry possesses true foliage leaves, and its flowers prove an excellent attraction for bees; specimens seen near the river banks at Corinda

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\*Possibly because for ease in sectioning young tissue was usually selected.

†Kerner and Oliver, I., 329.

and in the Botanic Gardens always claim attention during the flowering period by the buzzing of their numerous visitors.

The sepals have an upper and a lower epidermis, and, as is usual, show little differentiation of the mesophyll into spongy and palisade parenchyma. Air spaces are very numerous, and take up a large portion of the whole space filled by the mesophyll. Massed crystals, less acute than those forming the sphere-crystals of *Opuntia*, are found in the subepidermal layer, parallel to both surfaces.

The stem shows the usual division, on transverse section, into palisade layers, vascular bundles, and medulla or aqueous layer, as in *Opuntia*: but in all tissues except the vascular bundles, the cells are shortly oblong in outline, the longer axis being to the transverse axis as 3 : 2. In palisade cells the long axis is at right angles to the epidermis, in aqueous tissue it is parallel to the surface. Plate VI., Fig. 2.

V.—*Cereus grandiflorus*, Haw.

Epidermal cells have the wavy outline so common in similar cells of foliage leaves in numerous dicotyledons. The cells of the internal tissue are crowded with acicular (true) raphides, or crystals of oxalate of lime; and these are seen like a halo round the circumference of the plant section, having escaped from cut cells. A wound on the surface of this cactus, exposes a number of slime-cells containing raphides. Any rain or dew that fell would be imbibed by them in excess, and, their walls rupturing, the contained needles would be extruded, and form defensive *chevaux-de-frise* round the wounded portion. Plate V., Fig 2, and Plate VI., Fig. 1.

VI.—*Echinocactus Eylesii*, Luc.

The stem of this plant shows little differentiation of internal tissue. The cells of the central medulla differ little in shape from those of the palisade parenchyma, although the longest axis is parallel to the epidermis. In places the true epidermis, which does not take up the stain, is 6-7 cells thick, the extra layers formed of cork cells. It is probable that this is a defence against fungal attack. On the opposite surface the epidermis was normal—one

cell thick. In all positions it has a dermal layer, two cells in thickness, giving the reactions in the cell-wall for true cellulose. These cell-walls are greatly strengthened and absorb colour readily. In re-entering angles the dermal layer, or collenchyma, may be 4-5 cells thick. In places the strengthening layers have almost obliterated the cell cavity. In other respects the structure is that normal to the order. Plate VII., Figs. 1. 2.

VII — *Rhipsalis salicornoides*. D.C.

The thong-like stems of this plant, an epiphyte from the American forests, are in structure more like the stem of an ordinary dicotyledon, than any other yet examined. The stele contains numerous wood vessels, mostly spiral, but has the central aqueous tissue of the Cactæ instead of pith. The cortical regions, as shewn in longitudinal sections, are filled with the usual air-cavities, joined by tubes or passages to the stomata. All the cells—palisade cells and medullary tissue—are very minute. Crystals of oxalate of lime, in rhomboidal or irregular masses, are found mainly in the stele, and especially near the woody tissue

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# NOTES ON THE MARINE MOLLUSCA OF QUEENSLAND.

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## PART III

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By **JOHN SHIRLEY, D.Sc., F.M.S.**

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(Read before the Royal Society of Queensland, June 29th,  
1914.)

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SINCE publishing my last list of additions to the Queensland Marine Mollusca, a number of additional species have been reported, and there have been some changes in nomenclature to which attention should be drawn.

### **Class PELECYPODA.**

#### Family ARCIDÆ.

##### *Genus ARCA. Linnæus.*

*ARCA FUSCA*, Bruguière, No. 25, Hedley's list.

- s. *Arca pistachia*, Lamarck. Hanley, Recent Shells, p. 154, remarks "Smaller, but scarcely differing from *A. fusca*." From Murray Island specimens of *Arca fusca* have been received, some marked with a white ray from the umbo for some distance down the anterior slope, and with granulated ribs and delicate transverse striae; others without the ray and with decussated striae; and others again intermediate between the two forms.

Family PANDORIDÆ.

*Genus CÆLODON, Carpenter.*

CÆLODON AVERSUS, *Hedley*. Studies on Aust. Moll., Pt. XI., P.L.S. N.S.W., Vol. 38, 1913. Pt. 2, p. 266.

*s. Cælodon elongatus*, *Hedley non Carpenter*, P.L.S. N.S.W., 1906. Vol. 31. Pt. 3. p. 473 : *Hedley's* List No. 180.

Family TELLINIDÆ.

*Genus STRIGILLA, Turton.*

STRIGILLA SINCERA, *Hanley*. Studies on Aust. Moll., Pt. XI., P.L.S. N.S.W., Vol. 38. 272.

*s. Strigilla Grossiana*, *Hedley*, P.L.S. N.S.W., Vol. 33, 1908, p. 474, Pl. 9, f. 21. No. 427, *Hedley's* list.

Family DONACIDÆ.

*Genus DONAX, Linnæus.*

DONAX VERUINUS, *Hedley*. Studies on Aust. Moll., XI., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913. p. 274.

*s. D. nitida*, *Reeve*, of which the name is pre-occupied. No. 461, *Hedley's* list.

**Class GASTROPODA.**

**Order Amphineura.**

Sub-Order POLYPLACOPHORA.

**Chitones Regulares.**

Group ISCHNOIDEA.

*Genus CALLOCHITON, Gray.*

CALLOCHITON PLATESSA, *Gould*, Caloundra, T. Iredale, Proc. Mal. Soc., Vol. IX., Part III., Sep., 1910, p. 157.

*Genus ISCHNOCHITON, Gray.*

ISCHNOCHITON CRISPUS, *Reeve*, Caloundra, loc. cit, p. 157.

ISCHNOCHITON DIVERGENS, *Reeve*, Caloundra, loc. cit, p. 157

ISCHNOCHITON SMARAGDINUS, *Angas*, Caloundra, loc cit. p. 157.

ISCHNOCHITON SMARAGDINUS PICTURATUS. *Pilsbry*, Caloundra, loc. cit., p. 157.

Group LOPHYROIDEA.

Genus CHITON, *Linnæus*.

CHITON LIMANS. *Sykes*, Caloundra, loc. cit., p. 157.

CHITON nr. COXI. *Pilsbry*, Caloundra, loc. cit., p. 157.

Chitones Irregulares.

Group PLACIPHOROIDEA.

Genus ORNITHOCHITON, *Gray*.

ORNITHOCHITON QUERCINUS, *Gould*, Caloundra, T. Iredale, Proc. Mal. Soc., Vol. IX., Part III., Sep., 1910, p. 157.

Genus PLAXIPHORA. *Gray*.

PLAXIPHORA COSTATA, *Blainville*, Caloundra, loc. cit., p. 157.

Group MOPALOIDEA.

Genus ACANTHOCHITES, *Risso*.

ACANTHOCHITES COSTATUS, *Adams and Angas*, Caloundra, loc. cit., p. 157.

ACANTHOCHITES VARIABILIS, *Adams and Angas*, Caloundra, loc. cit., p. 157.

ACANTHOCHITES REJECTUS, *Pilsbry*, Caloundra, loc. cit. p. 157.

Order Prosobranchiata

Family FISSURELLIDÆ.

Genus EMARGINULA, *Lamarck*.

EMARGINULA BAJULA, *Hedley*, P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 276.

s. *E. dilecta*, *Hedley* non *A. Adams*, P.L.S. N.S.W., Nov., 1906, Pt. 4, p. 521, No. 565, *Hedley's* list.

## Family TROCHIDÆ.

*Genus CALLIOSTOMA. Swainson.*

CALLIOSTOMA POLYCHROMA. A. Adams (Hedley's list, No. 651). Studies Aust. Moll. P.L.S. N.S.W., Vol. 38. Pt. 2. 1913. p. 279.

s. *Trochus monile*. Hedley non Reeve, P.L.S. N.S.W., Vol. 33. 1907, p. 479. Hedley's list, No. 649.

CALLIOSTOMA COMPTUM. A. Adams. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38. Pt. 2. 1913. p. 279.

s. *C. purpureo-cinctum*, Hedley. P.L.S. N.S.W., Vol. 19, 1894. p. 35. text-figure.

*Genus CANTHARIDUS. Montfort.*

CANTHARIDUS FOURNIERI. Crosse. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., 38. Pt. 2. 1913, p. 281.

s. *Calliostoma oberwimmeri*. Preston. Shirley. Proc. Roy. Soc., 2., Vol. 23. 1911, p. 96.

## Family TURBINIDÆ.

*Genus TURBO. Linnæus.*

TURBO MILITARIS. Reeve. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38. Pt. 2. 1913, p. 282.

s. *T. imperialis*. Angas non Gmelin. Hedley's list, No. 680.

## Family RISSOIDÆ.

*Genus SCALIOLA. A. Adams.*

SCALIOLA BELLA. A. Adams. Hedley's list, No. 788.

s. *S. lapillifera*. Hedley. Moll. Funafuti. Mem. Aust. Mus. III., Pt. 7, p. 415.

## Family HYDROBIIDÆ.

*Genus IRAVADIA. Blandford.*

IRAVADIA CLATHRATA. A. Adams. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38. Pt. 2, 1913, p. 284.

s. *Pyrgula clathrata*, A. Adams. Hedley's list, No. 825.

Family CAPULIDÆ.

(Genus *CALYPTRÆA*, Lamarch.

*CALYPTRÆA TENUIS*, Gray, Hedley, Stud. Aust. Moll., P.L.S. N.S.W., 1913, p. 289.

s. *C. pellucida*, Tate, non *C. pellucida*. Reeve. Hedley's list, No. 832.

Family CERITHIIDÆ.

(Genus *CERITHIUM*, Adanson.

*CERITHIUM PIPERITUM*, Sowerby. Hedley's list, No. 858.

s. *C. strictum*. Hedley, Moll. Funafuti. Mem. Aust. Mus., III., Pt. 7, p. 433. A young shell differing only in the colour and smaller number of granulations.

*CERITHIUM LACTEUM*, Kiener, Shirley, Proc. Roy. Soc. Q'land, Vol. 23, p. 149.

s. *C. spiculum*, Hedley. Moll. Funafuti, Mem. Aust. Mus., III., Pt. 7, p. 433. A variable shell in the relation of its two major axes. The figure 21 is typical.

(Genus *CLAVA*, Humphries.

*CLAVA NODULOSA*, Bruguière, Hedley's list. No. 879.

s. *Contumax decollatus*, Hedley, Moll. Funafuti, Mem. Aust. Mus., III., Pt. 7, p. 437.

s. *Cerithium polygonum*, Sowerby. Hedley, Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913 p. 290.

Family TRITONIDÆ.

(Genus *CYMATIUM*.

*CYMATIUM DOLIARIUM*, Linnæus, Shirley, Proc. Roy. Soc. Q'land, 23, 1911, p. 98.

Hedley, P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 297, says, "All the specimens in the British Museum collection are from South Africa. There can be no doubt that these Australian records are fictitious." This kind of reasoning seems decidedly puerile. All the British Museum specimens of *Pyrene filmeræ*, Sowerby, were African, until

Queensland specimens were sent by me to Mr. E. A. Smith. It might as well be argued that the finding of *Cardita calyculata*, L., at Teneriffe, Voy. of Chall., XIII., pp. 10, 210, proves that it cannot exist in Australia : and the same with such shells as *Pecten limatula*, Reeve. at Tristan da Cunha, loc. cit., pp. 12, 297 : *Verticordia deshayesiana*, Fisher, at Pernambuco, loc. cit., pp. 4, 165. 167. *Arca imbricata*, Bruguière, from the West Indies, loc. cit., pp. 4, 259 : and *Arca corpulenta*, Smith, from Juan Fernandez, pp. 5, 263.

### Family TEREBRIDÆ.

*Genus TEREBRA, Adanson.*

TEREBRA FENESTRATA. *Hinds*, Proc. Zool. Soc., 1843, p. 153 ; *Thes. Conch.*, L. 1844, p. 176, Pl. 44, f. 86.

*T. cœlata*, Adams and Reeve. Hedley's Stud. Aust. Moll., XI., P.L.S. N.S.W., 1913, Vol. 38. Pt. 2, p. 305 ; Hedley's list, No. 1271.

TEREBRA POLYGYRATA. *Deshayes*, Hedley's Stud. Aus. Moll., XI., P.L.S. N.S.W., Pt. 2, 1913, p. 305 ; Hedley's list, No. 1286.

*s. T. subtertilis*, Smith. Shirley, Proc. Roy. Soc., Q., Vol. 23, 1911, p. 100.

TEREBRA TEXTILIS, *Hinds*, Proc. Zool. Soc., 1843, p. 156.

*s. T. turrita*, Smith. Hedley, Stud. Aust. Moll., XI., P.L.S. N.S.W., Vol. 38. Pt. 2, 1913, p. 305. Hedley's list, No. 1293.

### Family CONIDÆ.

*Genus CONUS, Linnæus.*

CONUS CYANOSTOMA. *A. Adams*. Hedley, Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 309.

*s. C. Coxeni*, Brazier. Hedley, No. 1304, *Marine Mollusca of Queensland*, loc. cit., p. 364.

### Family MITRIDÆ.

*Genus MITRA, Lamarck.*

MITRA SCULPTILIS, *Reere*. Hedley's list of Marine Mollusca of Queensland. No. 1492.

*s. M. delicata*, A. Adams, loc. cit., No. 1456.

MITRA COOKII, *Sowerby*. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 314.

s. *M. variabilis*. Angas non Reeve. Hedley's list, No. 1498.

### Family COLUMBELLIDÆ.

*Genus PYRENE*. *Bolten*.

PYRENE ACLEONTA, *Duclos*. Hedley. Stud. Aust. Moll., XI., P.L.S. N.S.W., 1913. Vol. 38. Pt. 2. p. 321.

s. *P. jaspidea*. *Sowerby*. Shirley. Proc. Roy. Soc., Q., Vol. 23. 1911, p. 101.

### Family MURICIDÆ.

*Genus TROPHON*. *Montfort*.

TROPHON RECURVUS, *Philippi*. Hedley. Stud. Aust. Moll., XI., P.L.S. N.S.W., Vol. 38. Pt. 2. 1913. p. 329.

s. *Trophon pairae*. *Crosse*. Hedley's list, No. 1624.

### Family EULIMIDÆ.

*Genus EULIMA*. *Risso*.

EULIMA CONSTELLATA, *Melville*. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2. 1913. p. 295.

s. *E. piperita*, Hedley, P.L.S. N.S.W., Vol. 34, 1909, p. 451, Pl. 43. f. 85.

## Order Opisthobranchiata.

### Family RINGICULIDÆ.

*Genus RINGICULA*, *Deshayes*.

RINGICULA DOLIARIS, *Gould*. Hedley, Stud. Aust. Moll., XI., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 336.

s. *Ringicula arctata*. Angas non Gould. Hedley's list, No. 1709.

- RINGICULA DENTICULATA. *Gould*. Hedley. Stud. Aust. Moll., XI., P.L.S. N.S.W.. Vol. 38, Pt. 2., 1913, p. 336.  
*s. Ringicula caran*, Angas non Hinds. Hedley's list, No. 1711.

Family TORNATINIDÆ.

*Genus RETUSA*, Brown.

- RETUSA DECUSSATA, *A. Adams*. Hedley, P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 337.  
*s. R. impasta*, Hedley, No. 1904. Marine Mollusca of Queensland.
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# SOME OIL-BEARING SEEDS INDIGENOUS TO QUEENSLAND.

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**By FRANK SMITH, B.Sc., F.I.C.**

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*(Read before the Royal Society of Queensland, August 14th,  
1914.)*

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## II.—THE OIL OF CALLOPHYLLUM INOPHYLLUM (Domba Nut).

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CALLOPHYLLUM INOPHYLLUM (N. O. Guttiferae), widely distributed over East Africa, the East Indies and Polynesia, occurs plentifully in Queensland on the northern seaboard. The tree is an evergreen, commonly referred to in literature as the Alexandrian Laurel, the fruits as Laurel or Domba Nuts, under which latter name they were submitted to me through the courtesy of Howard Newport, Esq., Instructor in Tropical Agriculture. The examination of their oil is interesting in comparison with Callophyllum inophyllum oil elsewhere reported.

An account of the oil appears in the Agricultural Ledger (1911-12, No. 5) "Oils and Fats of India" (Dictionary of Economic Products), and its commercial examination has recently been conducted at the Imperial Institute. (Bull. Imp. Inst., Vol. -XI., No. 4, Oct.-Dec., 1913.)

The Domba nut examined by the author agreed in general characteristics with Indian specimens. The average weight, enclosed in the dried pericarp, was 16.7 grams, of which the pericarp weighed 2.7 grams. The shell is soft, woody, and easily broken; the kernel yellowish-

white, oval, and averages 7.2 grams in weight. The sample here described would appear somewhat larger than those elsewhere reported. Examination of the ground kernel showed a moisture content of 21.7 per cent., and of oil extracted by low boiling-point petrol of 54.7 per cent.

The oil is viscous, yellow in colour with a slight greenish tinge, and of slight bitter taste and faint aromatic odour. A bulk extraction was made by compression in a screw press, and a quantity of oil obtained possessing a deep blue colour and depositing some amount of crystalline substance on standing.

The blue colour given by *Callophyllum* oils by contact with iron has already been noticed (Bull. Imp. Inst. loc. cit.), and was due in the present case to use of an iron press. The blue colouration was also obtained by treatment with a small amount of alcoholic ferric chloride and is ascribable to the presence of a resino-tannol hereafter noticed. The deposited crystals were ascertained to be stearic acid.

#### ANALYTICAL CONSTANTS OF THE OIL.

|               |         | Queensland<br>Sample. | Indian*<br>Sample. | Indian†<br>Sample. | Fijit<br>Sample. |
|---------------|---------|-----------------------|--------------------|--------------------|------------------|
| Sp. gr. at    | 15.5°C. | ..                    | .9394              |                    |                  |
|               | 15.5°C. |                       | .9415              |                    |                  |
| Acid Value    | ..      | 73.8                  | 67.5               | 77.5               | 16.2             |
| Hehner No.    | ..      | 95.5                  |                    | 92.9               | 91.9             |
| Sapon. Value  | ..      | 187.5                 | 198.7              | 194.9              | 204.0            |
| Iodine Value  | ..      | 100.0                 | 95.3               | 93.1               | 92.2             |
| Unsap. Matter | ..      | 1.0%                  | .35%               | 1.4%               | 1.4%             |

#### THE CONSTANTS OF THE SEPARATED ACIDS.

|                      | Queensland<br>Sample.‡ | Indian<br>Sample.* |
|----------------------|------------------------|--------------------|
| Neutralisation value | 193.7                  | 192.3              |
| Iodine value ..      | 92.0                   | 94.8               |

\* Agr. Ledger loc. cit.

† Bull. Imp. Inst., loc. cit.

‡ Contains 6.7 per cent. of resin acid.

## THE RESIN OF CALLOPHYLLUM INOPHYLLUM OIL.

The Indian oil is stated to contain 18.26 per cent of saponifiable resin which is separable by solution in hot dilute alcohol.

This treatment, however, removes a portion of free fatty acid and the separation was effected by the esterification method of Twitchell; 6.7 per cent of resin acid was obtained by this method as a dark viscid oil with a bitter taste. Its potash salt was soluble in excess of alcoholic potash, and it evidently possesses a high iodine absorption. It strikes an intense blue-black colouration with alcoholic ferric chloride.

## THE COMPOSITION OF CALLOPHYLLUM INOPHYLLUM OIL.

Fendler, quoted in the Agricultural Ledger (loc. cit), states this oil to contain palmitin, stearin and olein.

The fatty acids free from resin were found to have a neutralisation value of 199.8 corresponding to a mean molecular weight of 281.0. The iodine value is 78.0.

Separation of the liquid and solid fatty acids showed 73 per cent liquid and 27 per cent solid acids.

The iodine value of the liquid acids is 86.0 and precludes the presence of acids of higher degree of unsaturation than oleic acid. Fractional crystallisation of the solid acids from alcohol gave the following fractions: (1) incompletely melted at 85°C.; (2) M. Pt. 69.5° C.; (3) M. Pt. 68° C.; (4) M. Pt. 62° C. Further fractionation of (1) gave a small proportion of a crystalline substance melting at 110° - 112° C., which was not identified and probably is not a fatty acid.

Fractions (2) and (3) comprised the major portion and are stearic acid. Fraction (4) coincides in melting point with palmitic acid.

Hence the glycerides of Callophyllum oil are composed principally of olein and stearin with a smaller proportion of palmitin. The high acid number is due to the presence in the normal oil of a considerable proportion of free fatty acid, notably stearic acid.

## THE COMMERCIAL VALUE OF THE OIL.

It is interesting to note that *Callophyllum* kernels are quoted by the Imperial Institute as worth £16 per ton, basing the valuation on an oil content of 71 per cent., the kernels being notably drier than those examined in the present instance. The oil is undoubtedly, from its non-drying property, best adapted for soap-making purposes. Its bitter taste is detrimental to its edible property. It is stated to be used as a burning oil by natives in India. Examination of a press-cake containing 15 per cent of oil showed it to contain .32 per cent  $P_2O_5$ , .68 per cent  $K_2O$ , 1.40 per cent N. Its manurial and nutritive value is, therefore, low.

## SUMMARY.

(1) Queensland *Callophyllum inophyllum* kernels are rich in a non-drying oil closely agreeing in properties with the oil described elsewhere.

(2) The oil is associated with a resino-tannol.

(3) It consists of olein, stearin and palmitin, as stated by another investigator, and a considerable proportion of free fatty acid.

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III.—THE OIL OF THE SEED OF *HERNANDIA BIVALVIS* (Grease Nut.)

*HERNANDIA BIVALVIS* (N. O. Laurinæ) is a fair sized tree, evergreen and with a spreading head. It occurs widely distributed in the scrubs of Southern Queensland, though nowhere abundantly.

Mr. C. T. White supplies the following description of the fruit which matures in quantity in summer:—

“Fruit enclosed in an involucre which is nearly two inches broad, much inflated, scarlet in colour, fleshy when fresh, almost membranous and distinctly verticulate when dry: divided at the base into two valves. Fruit black, about 10 ribbed, with a small terminal umbo. Seed hard.”

K. T. Staiger\* dealing with the fruit and oil of the seed writes:—

“The shells of the fruit contain a dye soluble in soda, but not in ether, alcohol or water. The kernel contains 64.8 per cent of oil, which is similar to common laurel oil, is of the same consistency, and has, also, the same stearine and narcotic smell.”

I have confirmed this observation with regard to the black pigment of the “shell” and as to the general properties of the oil, which extracted from the seed proper has a greenish tinge.

A quantity of fruit was obtained in February from a tree at Kelvin Grove, Brisbane.

As it was impracticable to remove the investing pericarp from the seed, the extraction of the oil was made from the ground whole fruit, and the oil obtained was dark brown in colour, due to removal of portion of the colouring matter of the “shell.”

With regard to the percentage of oil present, extraction with low boiling-point petrol yielded 28.0 per cent. Since the “shell” constitutes approximately 35 per cent by weight of the entire fruit, the percentage calculated upon the seed proper or kernel to which its occurrence is confined, is 43.0 per cent, a figure appreciably lower than that given by Staiger.

The obviously oily nature of the seed, to which the popular name is attributable, has led to the chemical examination of the oil.

The seed is intensely bitter, and extraction of the oil with solvents removes also the bitter principle.

#### THE OIL.

The oil was extracted in bulk with ether, and is dark brown in colour, slightly viscid, and of very bitter taste. It possesses an oily and curious narcotic odour.

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\* Quoted in “The Queensland Flora,” p. 1316.

Determination of its constants was made with the following results:—

|                       |         |       |     |                |    |    |    |               |
|-----------------------|---------|-------|-----|----------------|----|----|----|---------------|
| Sp. gr. at            | 26°C.   |       |     |                |    |    |    | .932          |
|                       | 26°C.   |       |     |                |    |    |    |               |
| Acid Value            | ..      | ..    | ..  | ..             | .. | .. | .. | 18.0          |
| Hehner No             | (Insol. | acids | and | unsaponifiable |    |    |    |               |
| matter)               | ..      | ..    | ..  | ..             | .. | .. | .. | 95.2          |
| Unsaponifiable Matter | ..      | ..    | ..  | ..             | .. | .. | .. | 8.0 per cent. |
| Sapon. Value          | ..      | ..    | ..  | ..             | .. | .. | .. | 186.0         |
| Iodine Value          | ..      | ..    | ..  | ..             | .. | .. | .. | 108.0         |
| Reichert-Meissl Value | ..      | ..    | ..  | ..             | .. | .. | .. | 2.5           |

#### THE BITTER PRINCIPLE, RESIN ACID, AND UNSAPONIFIABLE MATTER.

The bitter principle present in the oil is soluble in water and alcohol and is removable by washing with these solvents. It is non-alkaloidal.

Saponification of the oil with alcoholic potash showed an amount of insoluble deposit which proved to be the potash salt of a resin acid. Solution in water and acidification gave a brown resinous material, taken to be a resin-acid anhydride.

The resin acid present is dissolvable in alcohol and was obtained as a white non-crystalline resinous substance insoluble in petroleum spirit. It amounted to 4.0 per cent on the weight of the oil.

The unsaponifiable matter is a brown resinous oil.

THE INSOLUBLE FATTY ACIDS\* were principally liquid and had the following constants:—

Neutralisation Value, 200.6, equivalent to Mean  
Molecular Weight, 279.5.

Iodine Value, 110.0.

Separated into their components, after removal of resin acid as potash salt insoluble in excess of alcoholic potash, there was obtained: liquid acids, 87 per cent; solid acids, 13 per cent.

THE LIQUID FATTY ACIDS. Iodine value, 119.0.

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\* Containing 4 per cent. of resin acid.

The comparatively high iodine value points to the presence of linoleic or linolenic acids.

In the products of oxidation by alkaline permanganate were identified dioxystearic acid (M. Pt.  $130^{\circ}$  C.) and a tetrahydroxy-stearic acid (sativic acid) (M. Pt.  $156^{\circ}$ - $160^{\circ}$  C). No linolenic hexabromide was yielded in the hexabromide test.

The liquid fatty acids are, therefore, oleic and linoleic acids.

THE SOLID FATTY ACIDS were fractionally crystallised from alcohol and were obtained in successive portions melting from  $60$ - $62^{\circ}$  C., approximating to the melting point of palmitic acid, which is, therefore, the solid fatty acid present.

No indication was obtained of the presence of lauric acid, the glyceride of which constitutes a large portion of other oils of the N. O. LAURINÆ described, such as oils of *Laurus nobilis* (common laurel oil), *Litsæa sebifera*, *L. Stocksii* and *L. zeylanica*.

#### SUMMARY.

(1) The oil of the seeds of *Hernandia bivalvis* is associated with a bitter principle, a resin acid, and a resin oil.

(2) It consists of olein, linolein and palmitin; laurin, which is a constituent of other oils of N. O. LAURINÆ, is not present.

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#### IV.—NOTE ON QUEENSLAND CANDLE-NUT OIL.

THE CANDLE NUT (*Aleurites moluccana* or *A. triloba*) is widely distributed over the tropics of the Eastern Hemisphere, and is exceedingly common in the northern scrubs of coastal Queensland.

The oil contained in the nut is of recognised value for a variety of purposes. It belongs to the class of drying oils typified by linseed oil, and besides being adapted for burning and soap-making, is suitable for the preparation of oil-varnishes, paints and linoleum, in the manufacture of which linseed oil is largely utilised.

The cathartic properties that are generally recognised as pertaining to both kernels and oil mitigate against dietetic use. The nuts, however, were a common article of diet among the Queensland aboriginal tribes, being principally utilised after roasting, the action of heat minimising the deleterious effect.

The oil has been frequently described\* but it has been deemed worth while to make a brief examination of that of Queensland origin from nuts kindly supplied by C. E. Wood, Esq., of the Kamerunga State Nursery.

Extraction with petroleum ether gave 70 per cent of pale yellow, limpid oil, a higher figure than generally reported.

Lewkowitsch gave 58.6 per cent : Guthrie and Ramsay found 59.93 per cent in a sample of Pacific Island nuts ; and Wilcox and Thompson report a maximum of 66.25 per cent.

The following constants were determined :—

|                      |    |    |                |
|----------------------|----|----|----------------|
| Saponification Value | .. | .. | 187.0          |
| Iodine Value         | .. | .. | 161.8          |
| Hexabromides         | .. | .. | 13.2 per cent. |

The iodine value agrees closely with the value given by Lewkowitsch, viz., 163.7, and the yield of hexabromides is markedly higher than the 7.28 - 8.21 per cent obtained by Walker and Warburton†, but below the value for linseed oil (23 per cent).

\* Lewkowitsch, "Oils, Fats, and Waxes." 3rd Edition, Vol. II., p. 468.

Guthrie and Ramsay. Agric. Gazette, N.S.W., 17 (1906), p. 859.

Wilcox and Thompson. Hawaii Agric. Exp. Stat. Bull 39 (1913).

† Analyst, 1902, 237.

Its drying power is undoubtedly high and but little inferior to that of some qualities of linseed oil.

The assertion is warranted that the candle-nut in Queensland constitutes an asset of considerable potential value.

I desire to acknowledge the facilities kindly placed at my disposal by the Agricultural Chemist, that have made the prosecution of this work possible.

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A NOTE ON THE PRECAVAL SYSTEM OF  
*HYLA CÆRULEA*, White.

---

By C. D. GILLIES, B.Sc.

BIOLOGICAL LABORATORY, UNIVERSITY, BRISBANE.

(PLATE VIII.)

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(Read before the Royal Society of Queensland, August 14th,  
1914.)

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ON account of its suitability for dissection, considerable numbers of *Hyla cærulea* are used in the Biology Department of the University of Queensland. Most of the text books on the anatomy of the frog (1). (2). (3). (4), describe species of *Rana*, and *H. cærulea* is found to differ in some respects from these. Considerable differences are shewn in the arrangement of the precaval blood vessels, and as this system had apparently not been previously described in *H. cærulea*. Miss Freda Bage, M.Sc., while Acting Lecturer in Biology at the University, suggested that I should undertake this investigation.

A number of frogs were examined, but no appreciable variations amongst the precaval systems of these was observed, and both the right and the left were found to be similar.

The precaval is formed by the union of three veins :—

A. LINGUAL.—This vein is the most anterior, and runs parallel to the long axis of the body, returning blood from the tongue.

B. INNOMINATE.—The innominate is the median vein, and is formed by the following :—

- (1) External jugular. This opens into the origin of the innominate, a short distance from the junction of the latter with the precaval. It is formed by :—
  - (a) Internal jugular, which returns blood from the head ; and the
  - (b) Mandibular, which comes from the lower jaw and into which, near the suspensorium, runs the maxillary vein from the upper jaw.
- (2) Subscapular. This vessel runs from the muscles of the shoulder, and receives a vein which returns blood from the muscles of the shoulder and the skin. It is proposed to term this vessel *the somatic vein*.

C. SUBCLAVIAN.—The subclavian is the most posterior vein, and is formed by the following :—

- (1) Brachial, which comes from the arm ;
- (2) Musculo-cutaneous, which returns blood from the walls of the abdomen and the skin ; and the
- (3) Coracoid, a small vein running into the subclavian, from the coracoid region.

In Southern Universities an allied species, *H. aurea*, is used in teaching anatomy. On comparison of the precaval system of *H. cærulea* with that of *H. aurea*, it is found that both agree in the possession of a coracoid vein, though Dr. Sweet (5) says that in *H. aurea* it is not always present, and two may occur. Another point of resemblance is the

possession in both forms of a branch from the skin, running into the mandibular vein at the angle of the jaw. The points of difference may be tabulated as follows:—

| Vein. ..    | <i>H. cœrulea.</i>   | <i>H. aurea.</i>  |
|-------------|--|---|
| Lingual ..  | Flows directly into the precaval                                 | Unites with the mandibular.   |
|             | Only one present.  | Generally a number of smaller veins open in front of the main vessel. |
| External .. | Runs into the innominate.  | Runs into the precaval.   |
| Jugular ..  | Formed by the mandibular and the internal jugular.               | Formed by the mandibular and the lingual.                             |
| Innominate  | Formed by the union of the subscapular and the external jugular. | Formed by the union of the subscapular and the internal jugular.      |
| Somatic ..  | Present.   | Absent.   |

The presence of the somatic vein in *H. cœrulea* and its absence in *H. aurea* is an important difference.

My thanks are due to Miss Freda Bage, M.Sc., and Dr. T. Harvey Johnston for their kind assistance.

#### BIBLIOGRAPHY.

- (1) Marshall, "The Frog."
- (2) Parker and Haswell, "Textbook of Zoology," Vol. II.
- (3) Thomson, "Outlines of Zoology."
- (4) Wells and Davies, "A Textbook of Zoology."
- (5) Sweet, G., Proc. Roy. Soc., Victoria. XXI., 1908, p. 349.

#### PLATE VIII.

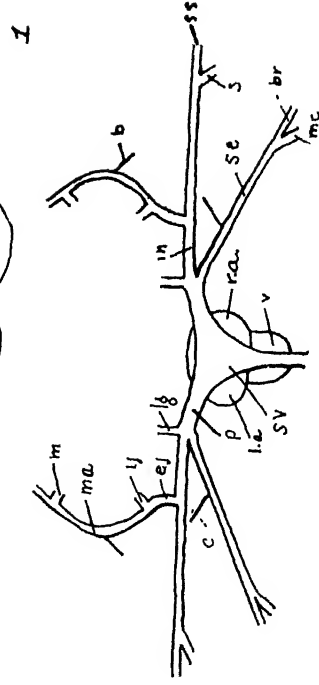
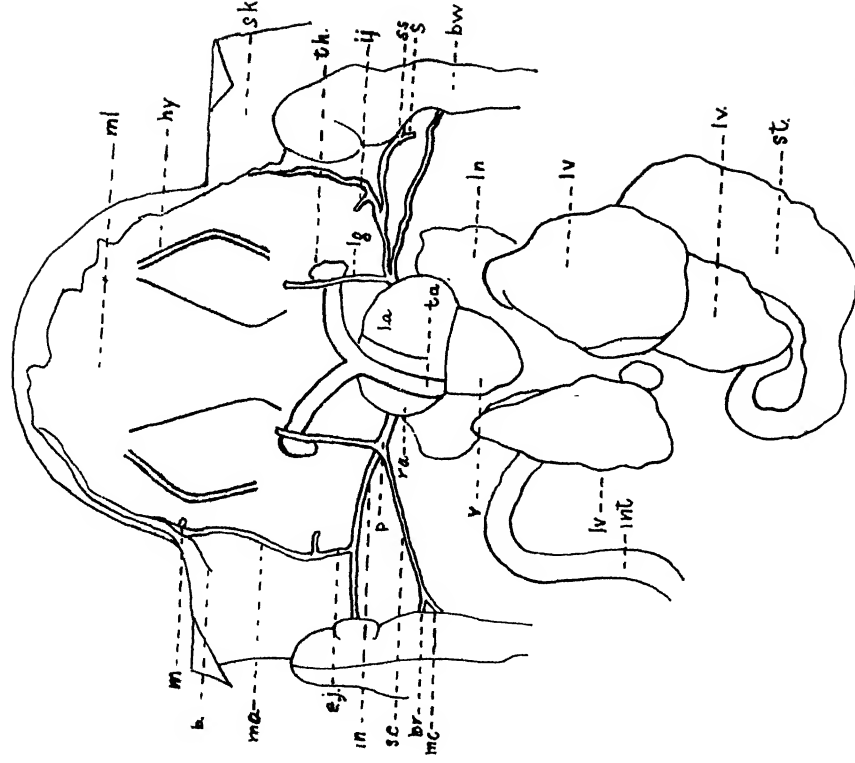
FIG. 1.—Sketch of a dissection of *Hyla cœrulea* from the ventral surface, shewing the precaval system.

FIG. 2.—Diagrammatic representation of the precaval system of *Hyla cœrulea*.

## REFERENCE TO LETTERING.

|      |                       |      |                        |
|------|-----------------------|------|------------------------|
| b.   | vein from the skin    | ma.  | mandibular vein        |
| br.  | brachial vein         | ml.  | muscle                 |
| bw.  | body wall             | mc.  | musculo-cutaneous vein |
| c.   | coracoid vein         | p.   | precaval vein          |
| ej.  | external jugular vein | r.a. | right auricle          |
| hy.  | hyoid bone            | s.   | somatic vein           |
| ij.  | internal jugular vein | s.c. | subclavian vein        |
| in.  | innominate vein       | sk.  | skin                   |
| int. | intestine             | st.  | stomach                |
| lg.  | lingual vein          | ss.  | subscapular vein       |
| ln.  | lung                  | sv.  | sinus venosus          |
| lv.  | liver                 | ta.  | truncus arteriosus     |
| l.a. | left auricle          | th.  | thyroid gland          |
| m.   | maxillary vein        | v.   | ventricle              |

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## NOTES AND EXHIBITS.

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(Before the Royal Society of Queensland, August 14th,  
1914).

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### ENDOPARASITES (TREMATODA).

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Dr. T. Harvey Johnston exhibited specimens of a trematode, *Dolichosaccus ischyrs*. J. S. Jnstn, which he had collected from the intestine of the common green frog, *Hyla cœrulea*, in the Brisbane district. This species was described by Dr S. J Johnston (Proc. Linn Soc., N.S. Wales, 36, 1912, p. 313, pl. 17), whose material was obtained from the same species of frog as well as from another in the neighbourhood of Sydney, N.S. Wales. The parasite is here recorded for the first time as occurring in Queensland.

He also exhibited specimens of a large trematode taken by Mr. A. C. Bligh, from the swim-bladder of a fresh-water catfish (Siluroid). *Copidoglanis tandanus*, caught in the Condamine River, near Warwick, Queensland. These parasites, which were obtained in February, 1911, through the kindness of the Government Entomologist, Mr. Henry Tryon, have proved to be a species of *Isoparorchis*. This genus was recently established by Southwell (Rec. Indian Museum 9 (2), 1913, pp. 91-95), for the reception of a species, *I. trisimilitubis*, Southwell, which was taken from the air-bladder of a fresh-water siluroid, *Wallago attu*, at Bankipur, in Northern India. It is of interest to find very closely related species of this genus occurring in freshwater catfish in two such widely-separated localities as India and Queensland. A full description of the Queensland species will be published by Dr. S. J. Johnston, of the Sydney University.

## ADDITIONS TO THE ROTIFERA OF QUEENSLAND.

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By **W. R. COLLEDGE.**

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*(Read before the Royal Society of Queensland, September 28th, 1914.)*

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THE present paper brings before the Society a few additions I have made to the known Rotifera of our State. In the year 1889, Surgeon Gunson Thorpe visited Brisbane, and subsequently gave to this Society two papers containing a list of 23 of these interesting microscopic animals. Four years ago I gave a paper extending the number to 102, I am now able to add 32, thus bringing the total up to 134 species. There are probably about 1,000 species which have been identified. These are distributed over all parts of the world. No country can claim exclusively any particular species. Some of the same kinds, found in Africa and Australia, were found on Ross Island in the Antarctic regions by Mr. James Murray. Some specimens were got from the bottom of a lake which had been solidly frozen for an unknown number of years. Fifteen feet of solid ice were bored before the layer of mud was reached in which they lay, but they recovered, and came to life immediately they were placed in water. At Padua, in Italy, ten species were found living in the hot springs at a temperature from 35° to 45° Centigrade. Thus, though of remarkably delicate and complicated organisation, they are capable of existing under a wide range of temperature

## LIST OF QUEENSLAND ROTIFERA.

The additions now made are marked with an asterisk, while those originally contributed by Gunson Thorpe are marked thus†.

## ORDER I.—RHIZOTA.

## Family 1.—FLOSCULARIADÆ.

- + *Floscularia coronetta*. Cubitt.
- .. *longicaudata*. Hudson.
- † .. *ornata*. Ehrenberg.
- .. *campanulata*. Dobie.
- \* .. *trilobata*. Collins.
- Stephanoceros eichornii*. Ehrenberg.

## Family 2.—MELICERTADÆ.

- † *Meliceria conifera*. Hudson.
- † .. *ringens*. Schrank.
- \* .. *tubicola*. Ehrenberg.
- † *Limnias annulatus*. Bailey.
- † .. *ceratophylli*. Schrank.
- \* *Cephalosiphon limnias*. Ehrenberg.
- Æcistes brachiatus*. Hudson.
- .. *crystallinus*. Ehrenberg.
- \* *Lacinularia elliptica*. Shepherd.
- \* .. *racemorata*.
- \* .. *socialis*. Ehrenberg.
- \* *Megalotrocha alboflavicans*. Ehrenberg.
- .. *semibulla*. Thorpe.
- .. *spinoza*. Thorpe.
- Conochilus dossuarius*. Hudson.
- .. *unicornis*. Rousselet.
- .. *collosa*. Ehrenberg.

## ORDER II.—BDELLOIDA.

## Family. PHILODINADÆ.

- † *Philodina citrina*. Ehrenberg.
- \* .. *megalotrocha*. Ehrenberg.
- † *Rotifer vulgaris*. Schrank.
- † *Actinurus neptunius*. Ehrenberg.

## ORDER III.—PLOIMA

Sub-Order. *Illoricata*

## Family. MICRODIDÆ.

*Microdida chlæna*.

## Family. ASPLANCHNADÆ.

*Asplanchna amphora*. Hudson." *amphora*, male." *brightwellii*.\* " *intermedia*. Hudson.\* *Asplanchnopus myrmelio*.

\* " " male.

*Sacculus viridis*. Gosse.*Syncheta oralis*." *stylata*. Wierz." *tremula*. Ehrenberg.

## Family. TRIARTHRADÆ.

† *Polyarthra platyptera*. Ehrenberg.*Triarthra longiseta*. Ehrenberg.*Cyrtonia tuba*. Rousselet.

## Family. HYDATINADÆ

*Notops brachionus*. Ehrenberg." *clavulatus*. Ehrenberg.\* *Triphylus lacustris*. Ehrenberg.

" " male.

## Family. NOTAMMATIDÆ

*Taphrocampa annulosa*. Gosse.*Notammata aurita*. Ehrenberg." *clavulata*. Ehrenberg." *brachionus*. Ehrenberg.*Copeus copeus*. Ehrenberg." *cerberix*. Gosse." *pachyurus*. Gosse.*Cœlopus brachyurus*.*Diglena forcipata*." *grandis*.*Eosphora aurita*. Ehrenberg." *digitata*.

- Furcularia longiseta*. Ehrenberg.  
 „ *equales*. Ehrenberg.  
 \* „ *forficula*. Ehrenberg.  
 \* „ *melandicus*.  
 „ *microphus*.  
 \* *Proales parasitica*. Ehrenberg.  
 „ *sordida* Gosse.  
*Triophthalmus dorsalis*. Ehrenberg.

Sub-Order. *Loricata*.

## Family. RATTULIDÆ.

- Rattulis bicornis*. Ehrenberg.  
 „ *bicristata*.  
 „ *birostris*.  
 „ *carinatus*. Ehrenberg.  
 „ *elongata*. Gosse.  
 „ *mucosus*. Ehrenberg.  
 „ *tigris*. Müller.  
*Diurella porcellus*. Gosse.

## Family. DINOCHARIDÆ.

- Dinocharis tetractis*. Ehrenberg.  
 „ *collinsii*. Gosse.  
*Scaridium eudactylosum*. Gosse.  
 † „ *longicaudum*. Ehrenberg.  
 \* *Stephanops intermedius*. Burn.

## Family. SALPINADÆ.

- \* *Diachiza cæca*. Gosse.  
 „ *paeta*. Gosse.  
 „ *semiaperta*. Gosse.  
*Salpina brevispina*. Ehrenberg.  
 \* „ *cortina*.  
 † „ *eustala*. Gosse.  
 „ *macracantha*. Gosse.  
 \* „ *ventralis*.  
*Diplax trigona*. Gosse.  
 † *Diplois daviesiæ*. Gosse.

## Family. EUCHLANADÆ.

- Euchlanis dilatata*. Ehrenberg.  
 „ *oropha*.  
 † „ *triquetra*. Ehrenberg.

## Family. CATHYPNADÆ.

- \* *Cathypna brachydactyla*. Stenross.  
 „ *leontina*.  
 † „ *luna*. Ehrenberg  
 \* „ *ungulata*.  
*Monostyla bulla*. Gosse.  
 „ *cornuta*. Ehrenberg.  
 † „ *lunaris*. Ehrenberg.  
 „ *quadridentata*. Ehrenberg.

## Family COLURIDÆ.

- † *Colurus amblytelus*. Gosse.  
 „ *dactylopus*. Gosse.  
 „ *deflexus*. Ehrenberg.  
*Metopidia acuminata*. Ehrenberg.  
 „ *lepadella*. Ehrenberg.  
 „ *oblonga*  
 \* „ *oralis*.  
 \* „ *ohioensis*.  
 „ *oxysternum*. Gosse.  
 „ *solidus*. Gosse.  
 „ *triptera*. Ehrenberg.  
*Cochleate turbo*.

## Family. PTERODINADÆ.

- \* *Pterodina incisa*. Ternety.  
 \* „ *reflexa*. Gosse.  
 † „ *patina*. Ehrenberg.

## Family. BRACHIONIDÆ.

- Brachionus angularis*. Gosse.  
 † „ *bakerii*. Ehrenberg.  
 „ *falcatus*. Zacharius.  
 † „ *militaris*. Ehrenberg.  
 „ *pala*. Ehrenberg.  
 „ „ var. *amphiceros*.  
 „ *rubens*. Ehrenberg.  
 „ *urceolus*. Ehrenberg.  
*Noteus quadricornis*. Ehrenberg.

## Family. ANURÆADÆ.

- † *Anuræa aculeata*. Ehrenberg.  
 „ „ no ventral spines.  
 „ *cochlearis*. Gosse.  
 „ *tecta*. Gosse.

## Family. PLEOSOMADÆ.

- Pleosoma lenticulares*. Vorce and Herrick.  
*Gastropus minor*.  
 „ *stylifer*.  
*Anapus ovalis*.

## ORDER. SCIRTOPODA.

## Family. PEDALIONIDÆ.

- † *Pedalion mirum*. Hudson.  
 † *Trochosphæra æquatorialis*. Semper  
 † „ „ male
-

## SOME NEW QUEENSLAND ENDOPARASITES.\*

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By **T. HARVEY JOHNSTON, M.A., D.Sc., F.L.S.**

BIOLOGY DEPARTMENT, UNIVERSITY, BRISBANE.

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(PLATES IX. & X.)

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(Read before the Royal Society of Queensland November  
9th, 1914)

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*Sphærouterina punctata* n. sp.

(Pl. IX., figs 1-13.)

FROM the intestine of a "thickhead" or "whistler," *Pachycephala rufiventris* Lath. shot at Caloundra, August, 1914, there were collected numerous pale translucent cestodes reaching about 4 cm in length, and about .65 mm in maximum breadth. The posterior segments readily separated off from the rest of the strobila owing to the presence of very deep constrictions. Each ripe proglottid was seen to contain in its anterior half a dark or brownish rounded egg capsule, this "spotted" appearance suggesting its specific name.

*Scolex*.—The scolex, whose breadth is .31 mm. bears prominent suckers and rostellum. capable of being withdrawn into a powerful muscular rostellar sac. The rostellum is provided with two series of hooks, those in the anterior circlet being larger than those forming the second row, with which they alternate. There are ten or twelve in each series. The hooks of the first circlet are rather wide and

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\*The types of the new species described in this paper as well as in a former paper, "Notes on some Entozoa," Proc. Roy. Soc. Queensland, XXIV., 1912, pp. 63-91, have been deposited in the Queensland Museum, Brisbane.

measure .07 mm from the tip of the claw to the dorsal root. Those of the other set are .45 mm long, and have a different shape, the claw being shorter and more strongly curved. They more closely resemble those described from species of *Buterina* than do the anterior hooks. The dorsal and ventral roots are considerably thickened in both sets.

*Strobila* —An unsegmented neck is absent. Immediately behind the scolex, proglottids measure nearly .2 mm in width, and though short, are quite distinct. Sexually mature joints are about .13 mm in length and .3 mm in maximum breadth. They gradually become relatively longer, until their dimensions are about .4 mm and .5 mm respectively. Mature segments, found free in the intestine, were about .75 mm long and .7 mm wide, their shape being that of a triangle with the apex removed. The large egg capsule occupies the apical region, unless it has been already extruded. The postero-lateral edges of older segments project freely. The amount of overlapping is small.

Genital pores alternate irregularly and lie marginally just in front of the middle of the proglottid. There is a genital cloaca. Only rarely can a genital papilla be seen.

Calcareous corpuscles of at least two kinds, large and small, are to be found in the cortex. The former, which are rare, are somewhat disc-shaped with radiating depressions on the surface, and may measure as much as .02 mm. The smaller ones are fairly common and possess the usual rounded or elliptical outline. They measure about .007-.008 mm by .005-.004 mm.

The longitudinal musculature is arranged in two concentric series of rather large bundles, the individual bundles, as well as the series, being close to one another. Transverse fibres are to be seen occasionally in sections, their position being internal to the longitudinal series.

The ventral excretory canal is relatively very wide, the small dorsal vessel being directly above it. The latter has a more sinuous course than the former. A

wide transverse vessel connects the ventral canals near the posterior end of each segment. The main longitudinal nerve is situated immediately dorso-laterally to the ventral canal of the corresponding side. The sexducts pass between the excretory vessels and dorsally to the nerve.

*Male genitalia* :—There are about eight testes each 30-40  $\mu$  in diameter, lying behind the ovary and uterus, but above the vitellarium. Occasionally some occur in the medulla between, and laterally from, the excretory canals.

The vas deferens becomes considerably coiled on the pore side of the uterus and paruterine organ. It lies above and close to the vagina, its course being approximately parallel to it. Both of these ducts pass outwards just dorsally to the nerve and ventral vessel, the vas deferens entering the small cirrus sac within whose inner portion it becomes coiled. The cirrus sac is a pyriform structure, 25-30  $\mu$  in maximum width and 50-60  $\mu$  in length. Its musculature is weak. The organ does not extend inwardly as far as the excretory canals. It contains a small cirrus. The male pore lies at the bottom of a genital cloaca, its position being immediately dorsal or antero-dorsal to the female aperture.

*Female organs* :—The small bilobed ovary lies in the anterior part of the segment, in front of the testes. It is not median but is situated in an oblique position nearer the pore-bearing edge. The vitellarium is placed posteriorly below the testes.

From the female aperture which lies just below the male pore, the vagina travels inwards below and beside the vas deferens and immediately above the nerve and ventral excretory canal. A small receptaculum seminis may be recognisable. The vagina bends slightly backwards.

The uterus appears near the centre of the segment but rather towards the aporal side, just in front of, and ventrally to the testes, but behind the ovary. It is a simple spherical sac. As it develops the testes and ovary soon disappear. A mass of altered parenchyma makes its appearance antero-ventrally from the uterus, this par-

terine organ developing rapidly. At first it is a short, narrow, longitudinally-placed, more or less median, mass of tissue, becoming tubular. The position of the uterus undergoes alteration, this organ being gradually displaced so as to lie in the posterior part of the proglottid, though occasionally it remains in the middle of the segment as a very large simple sac with numerous ripe eggs within it. The anterior part of the paruterine organ undergoes differentiation to form an expanded rounded capsule, the tubular portion becoming wider and more sinuous. This capsule is sharply marked off from the surrounding tissues, especially laterally and anteriorly. It increases in size and ultimately occupies most of the medulla of the anterior part of the segment. Its dimensions while within the proglottis vary from .22 by .14 mm to .30 by .24 mm. Some which had been extruded from the segment measured .4 by .3 mm.

The capsule consists of an outer coarse layer which stains very deeply with eosin and of an inner zone which retains the hæmatoxylin dye. It is within the latter that the eggs come to lie imbedded. The outer layer does not cover the posterior face of the capsule, the egg-containing tissues being in continuity with the paruterine organ, through which the eggs have travelled from the uterus to the capsule. The peripheral region of the inner zone of the capsule possesses numerous rod-like structures resembling crystalloids, but they do not polarise light. Eggs may occur in this peripheral area. A few fusiform granular bodies were seen in this layer in several capsules.

The paruterine organ has a vacuolate appearance and has what seems to be an axial series of nuclei. The contents of the tube appear to be albuminous.

Ripe eggs are to be found in the capsule and more or less commonly in the uterus.

They measure from .035 by .030 mm to .040 by .035 mm., the contained oncosphere being about .024 mm. in diameter. The embryonal hooklets are .010-.012 mm long, with a long claw whose length is equal to the distance between the dorsal and ventral roots.

*Systematic*:—The parasite belongs to the Paruterinidæ, but differs from the armed genera, *Biuterina*, *Paruterina* and *Culcitella*. The arrangement of the excretory canals is characteristic in the last named. The uterus is simple in our form whereas it is more or less completely bilobed in *Biuterina* and crescentic or else rather broader than long in *Paruterina*. Besides, the testes are numerous in the last named two genera whereas they are few in the cestode from *Pachycephala*. It appears to resemble *Rhabdometra* in many ways, but the latter has an unarmed scolex.

The new genus for which the name *Sphærouterina* is proposed, may be characterised as follows:—Paruterinidæ; rostellum armed with two rows of hooks; genital pores alternating irregularly; genital ducts passing between the excretory canals and dorsally to the longitudinal nerve; testes few, situated behind the female organs; uterus rounded and simple; paruterine organ terminating in an anteriorly-situated capsule—near *Paruterina* and *Biuterina*. In birds.

*Type*: *Sphærouterina punctata* Jnstn from *Pachycephala rufiventris* Lath.

*Thelastomum alatum* n. sp. (Oxyuridæ.)

(Pl. X., figs. 3-7.)

From the intestine of the larva of a Cetonid beetle, *Cacachroa decorticata* MacI, from Cairns, North Queensland, collected by Mr A. A. Girault, and forwarded through the Director of the Queensland Museum, Brisbane.

*Female*:—Total length 2.9 mm; the tail, i.e., from the anus to the posterior end of the parasite, being .9 mm. (figs. 3, 5.) The female is rather a stout worm whose anterior end is gradually narrowed. The posterior region becomes strongly constricted to form a long, almost straight, sabre-like tail of fairly uniform width except at the end, where it is pointed. The greatest breadth is the region of the vagina (about .20 mm). This organ terminates on a relatively large, backwardly projecting prominence situated in the posterior half of the body, about .6 mm in front of the anus.

The mouth is borne on a small, projecting ring well marked off from the rest of the body. The pharynx, including the gizzard, has a length of .50 mm. Just prior to entering the latter, it narrows somewhat. The pyriform gizzard has a diameter of .09 mm, and is marked off from the rest of the pharynx by a constriction. The intestine is wide and croplike in its anterior portion, with a diameter of .15 mm, soon becoming narrowed to about half this. The nerve ring lies at .2 mm behind the mouth, while the excretory pore is situated in the region of the gizzard at about .4 mm behind the mouth. The short common excretory duct has a somewhat sinuous course.

The ovary can be traced from the dorsal region near the anus, where it may form a loop, forwards almost to the gizzard. Here it turns back almost to the anus in a more ventral position than before. Fertilisation occurs in this region and the duct travels anteriorly as a wide uterus crowded with eggs, commonly arranged in two rows, terminating at the female genital pore, which, as already stated, lies on an eminence. Ripe eggs measure about .08 by .05 mm.

*Male*:—The male is very small, measuring from .97 to 1.17 mm. in length, the maximum breadth being about .09 mm. (Figs. 4, 6, 7.) The anus projects strongly, and behind it the body is narrowed rapidly to form a short tail .06 mm long, whose anterior half is much broader than the posterior half. The latter terminates in a fine point. The former is arched dorsally and at its junction with the posterior part is a pair of tail papillæ. At each side of the hind portion of body is a prominent ala, which, just in front of the anal region, is somewhat arched and expanded. It becomes narrowed and then again widened to form a rather thin rounded lobe lying above the anus and terminating at the base of the tail. The nerve ring is situated at about .09 mm, and the excretory aperture at about .17 mm from the anterior end. The testis is relatively large. The male spiculum measures .045 mm and is clubshaped and slightly curved, its point being sharp. There appear to be a pair of small papillæ in the neighbourhood of the anus.

*Spiroptera megastoma* Rud.

From a tumour in the stomach of a horse, Eidsvold, Burnett River, collected by Dr. T. L. Bancroft. This species, though probably not uncommon, is apparently now recorded for the first time as occurring in Queensland.

*Agamonema* sp.

(Pl. X., figs. 1, 2.)

A small number of white ellipsoid cysts were taken recently from *Hyla cærulea* caught in Brisbane (Oct, 1914). They were lying more or less loosely in the wall of the stomach, just below the peritoneum. Each contained a single nematode, probably a *Spiroptera*, lying in its central area, surrounded by a tough fibrous coat, the "worm area" being about half the diameter of the cyst. The largest cyst measured .9 mm by nearly .7 mm and the smallest .65 by .47 mm.

By teasing out the capsule, the contained worm was liberated. The following account is based upon the largest parasite obtained.

Length 3.10 mm; breadth .010 mm. The body is finely annulate, the rings being, however, scarcely recognisable anteriorly. The anterior end is rounded and only slightly attenuated while the posterior extremity is pointed, there being a short tail, .010 mm, in front of whose end lies the anus. The three lips each bear a small labial papilla, not readily detected. Delicate longitudinal striæ are recognisable on the cuticle of the body.

There is a relatively long tubular pharynx, .43 mm in length, terminating in a slight swollen portion. The anterior end of the intestine is rounded, a deep constriction separating it from the pharynx. The cloaca extends inwards for .075 mm from the anus and is lined by a thick cuticle which is so disposed that it has the appearance of two approximately equal spicules with rounded or clublike inner ends separated from each other, and with sharp outer extremities. It is possible that these may be two male spicules or a single deeply-grooved seta with a bifurcate end.

The nerve ring lies at a distance of 0.15 mm behind the mouth, and immediately in front of the ring is the excretory aperture.

This larval parasite appears to belong to the Spiropteridæ and is included for the present under the collective generic name, *Agamonema*.

*Echinorhynchus hylæ* n. sp.

(Pl. X., figs. 8, 9.)

A solitary specimen of this species was found recently, encysted just below the peritoneal surface of the liver of a frog, *Hyla cærulea*, caught near Brisbane. The white cylindrical cyst measured 1.4 mm in length and about .5 mm in width.

Though the parasite was in a larval stage, yet enough of its anatomy was recognised to justify naming it. I have compared it with an *Echinorhynch* which was described by me in 1912,\* from a *Hyla aurea* caught near Sydney some years ago and am satisfied that the two belong to the same species. They have the same size and general appearance. The characters of the rostellum are described there. In our present specimen this organ is not fully everted but the hooks on its base correspond in shape, size and arrangement with those similarly placed in the case of the former parasite (fig. 9).

The rostellar sac with the introverted rostellum measured .9 mm in length. One giant nucleus was distinctly seen, and there appeared to be a second one present. Each lemniscus measured .5 mm, being of about the same length as the introverted proboscis. They were rather shorter than those present in the specimen from *Hyla aurea*. The suspensory ligament and associated organs, were considerably coiled and consequently the details of structure were not satisfactorily made out. Sex glands were not recognised, though the vas deferens, vesicula, and the relatively large copulatory bursa were to be seen. The walls of the bursa were thick and much folded internally. The general anatomy is shown in pl. X. fig. 8.

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\*Proc Roy. Soc. Queensland, XXIV., 1912, pp. 84-85, pl. II. figs. 9, 10

## PLATE, IX.

*Sphaeruterina punctata* n. sp.

- Fig. 1. Eggs.  
 Fig. 2. Ripe proglottis, showing capsule; also eggs in uterus.  
 Fig. 3. Free segment showing capsule almost extruded.  
 Fig. 4. Scolex.  
 Fig. 5. Hooks of first series.  
 Fig. 6. Hooks of second series.  
 Fig. 7. Segment showing genitalia.  
 Fig. 8, 9. Segments showing developing paruterine organ.  
 Fig. 10. Longit. horiz. sect. of segment.  
 Fig. 11. Part of fig. 10, more highly magnified.  
 Fig. 12. Trans. sect. segment, showing capsule.  
 Fig. 13. Trans. sect. segment, showing genital pore.

## PLATE. X.

*Agamonema* sp. from *Hyla caerulea*.

- Fig. 1. Anterior end.  
 Fig. 2. Posterior end.

*Thelastomum alatum* n. sp.

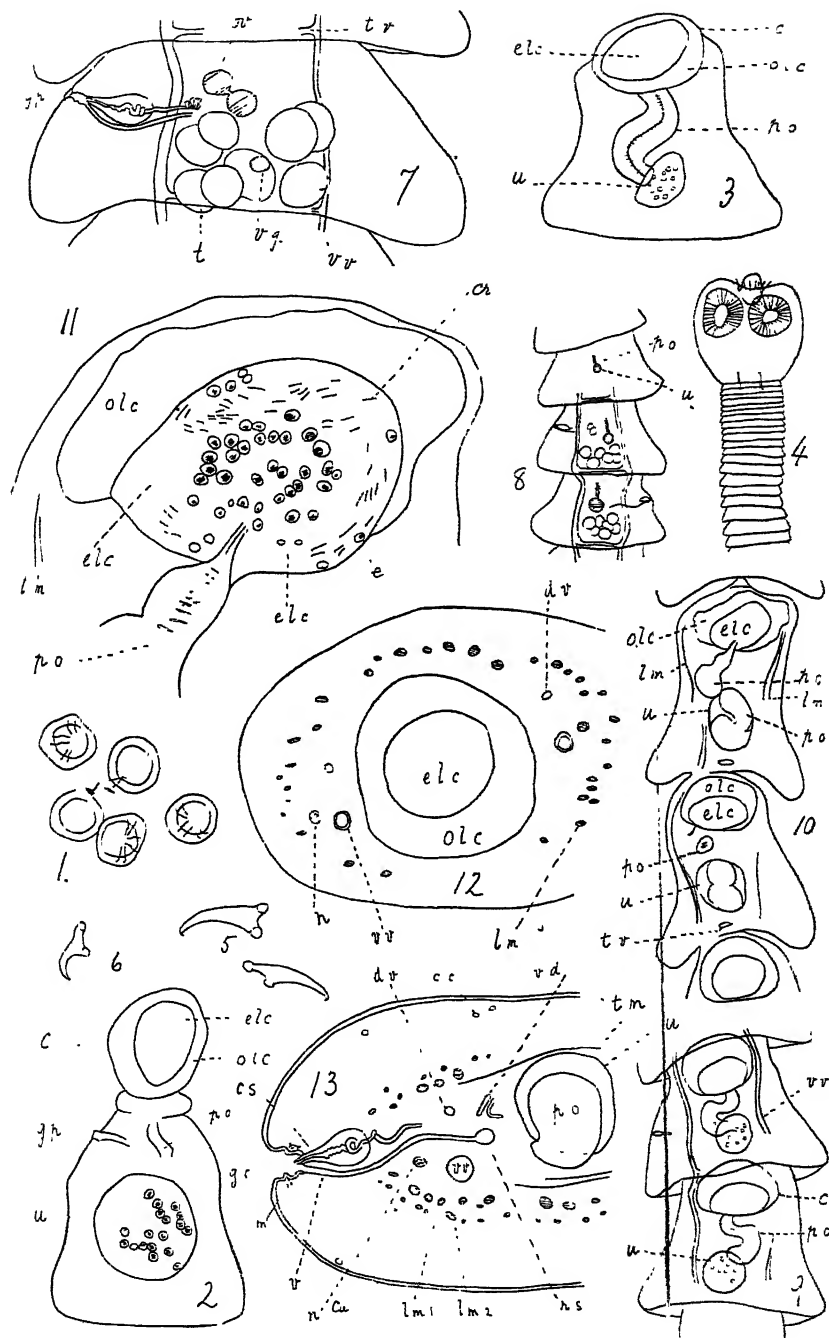
- Fig. 3. Female worm.  
 Fig. 4. Male worm—same magnification as fig. 3.  
 Fig. 5. Female, anterior end.  
 Fig. 6. Male, anterior end, same magnification as fig. 5.  
 Fig. 7. Male, posterior end, same magnification as fig. 6.

*Echinorhynchus hyla* n. sp.

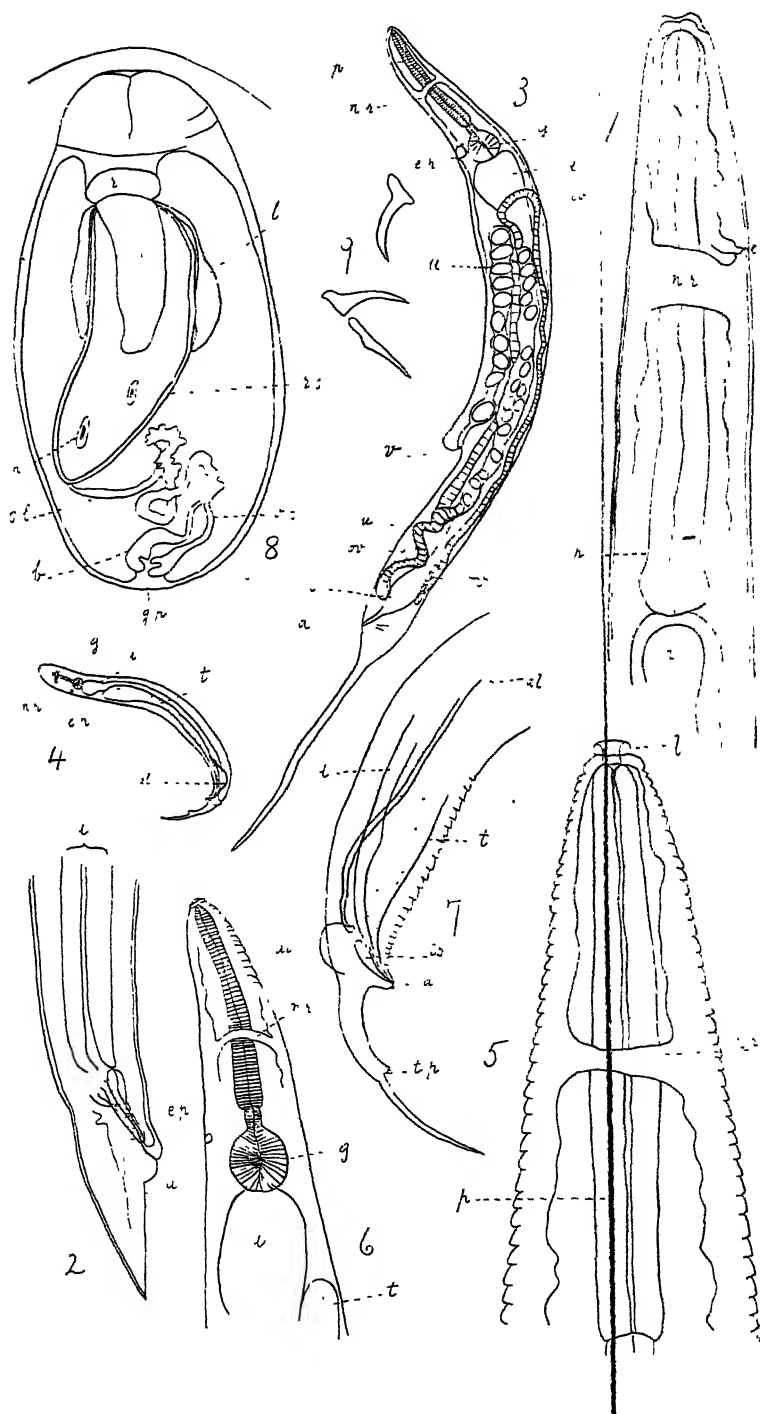
- Fig. 8. Entire specimen.  
 Fig. 9. Hooks from base of rostellum—seen from various positions.

## REFERENCE TO LETTERING.

a. anus; al., ala; b., bursa; c., capsule; c.c., calcareous corpuscle; cr., ? crystalloids; c.s., cirrus sac; cu., cuticle; d.v., dorsal excretory vessel; e., egg; e.l.c., egg-containing layer of capsule; e.p., excretory pore; g., gizzard; g.n., giant nucleus; g.c., genital cloaca; g.p., genital pore; i., intestine; l., lip; lem., lemniscus; l.m., l.m. 1., l.m. 2., longitudinal muscle bundles; m., muscle; n., nerve; n.r., nerve ring; o.l.c., outer layer of capsule; ov., ovary; p., pharynx; p.s., proboscis sheath; p.o., paruterine organ; r., rostellum; r.s., receptaculum seminis; s., sucker; s.l., suspensory ligament; sp., spicule; t., testis; t.m., transverse muscle; t.p., tail papilla; t.v., transverse excretory vessel; u., uterus; v., vagina; v.d., vas deferens; v.g., vitelline gland; v.s., vesicula seminalis; v.v., ventral excretory vessel.









# THE FREEZING POINT OF SOME ABNORMAL MILKS.

By J. B. HENDERSON, F.I.C., and  
L. A. MESTON.

(Read before the Royal Society of Queensland, November 9th, 1914.)

ON the 15th May, 1914, among several samples of milk submitted for analysis in the Government Chemical Laboratory, Brisbane, by a Food Inspector, were two, from different sources, which gave the following results on analysis:—

|  | No. 4349.<br>(6 cows) | No. 4353<br>(2 cows) |
|--|-----------------------|----------------------|
| Total Solids .. .. .                             | 11.60 per cent        | 11.69 per cent       |
| Fat .. .. .                                      | 3.86 per cent         | 3.90 per cent        |
| Solids not fat .. .. .                           | 7.74 per cent         | 7.79 per cent        |
| Ash .. .. .                                      | 0.80 per cent         | 0.78 per cent        |
| Nitrogen .. .. .                                 | 0.49 per cent         | 0.47 per cent        |
| Chlorine in Ash .. .. .                          | 22.6 per cent         | 22.6 per cent        |
| Chlorine in Ash as NaCl .. .. .                  | 37.2 per cent         | 37.2 per cent        |
| Ratio $\frac{\text{Ash}}{\text{NaCl}}$ .. .. .   | 2.68                  | 2.68                 |
| Ratio $\frac{\text{Ash}}{\text{S.N.F.}}$ .. .. . | 10.3                  | 10.0                 |
| Freezing Point .. .. .                           | 0.55°C                | 0.54°C               |
| Composition of Solids not fat:—                  |                       |                      |
| Milk Sugar .. .. .                               | 49.2 per cent         | 51.4 per cent        |
| Proteids .. .. .                                 | 40.3 per cent         | 38.4 per cent        |
| Ash .. .. .                                      | 10.3 per cent         | 10.0 per cent        |

The fat, solids not fat, and nitrogen are all low, while the ash is just a shade above normal and the proportion of chlorine in the ash much above normal. The freezing point is however in each case practically normal.

At first glance the analytical results seem to indicate that each milk is a milk which has been watered, and a little common salt added to lower the freezing point again to normal. Added water, if calculated on the basis of a normal solids not fat of 8.9 per cent., in sample "A" would reach 13 per cent. The excess of salt present in the sample would lower the freezing point to cover an addition of 12.5 per cent. of added water. Similarly added water in sample "B" if calculated on the 8.9 solids not fat standard would reach 12.5 per cent., while the excess of salt present would lower the freezing point to cover 12 per cent. of added water. In each case there is a remarkable agreement between the deduction made from the solids not fat standard and that from the excess of salt.

As against the weight of analytical evidence for adulteration there stands the fact that the freezing point was in each case normal and that it would probably be beyond the skill of any dairyman to exactly adjust the freezing point of the mixture of water and milk.

The attention of the Commissioner of Public Health was called to the peculiar facts of these two cases, and it was decided to investigate each case further.

It was found that the samples were from the same district, sample "A" being the mixed milk from six cows, and "B" the mixed milk from two cows.

Twelve days after the legal samples were taken, a food inspector familiar with the milking of cows attended in the afternoon at each dairy, saw each cow milked and "stripped," and measured and sampled the milk from each cow. The mixed milk in each herd was unfortunately not sampled, the results given for the mixed milk in the following table being calculated from the individual yield.

HERD A.—(6 COWS.)

| Cows.   | 1        | 2        | 3        | 4        | 5        | 6        | Mixed Milk. | Normal Milk.  |
|---|----------|----------|----------|----------|----------|----------|-------------|---------------|
| Yield (Quarts)  | 2        | 2        | 1        | 4        | 3        | 3        | 15          |               |
| Total Solids .. ..  | 12.9     | 12.8     | 9.2      | 11.9     | 13.8     | 12.1     | 12.1        | 12.9 per cent |
| Fat .. ..   | 5.0      | 4.0      | 2.8      | 3.7      | 4.6      | 3.7      | 4.0         | 4.0 per cent  |
| Solids not fat .. ..                                      | 7.9      | 8.8      | 6.4      | 8.2      | 9.2      | 8.4      | 8.4         | 8.9 per cent  |
| Ash .. ..   | 0.88     | 0.70     | 0.89     | 0.69     | 0.77     | 0.74     | 0.76        | 0.75 per cent |
| Nitrogen .. ..  | 0.62     | 0.50     | 0.48     | 0.47     | 0.58     | 0.50     | 0.52        | 0.52 per cent |
| Chlorine in Ash ..  | 22.2     | 14.4     | 28.7     | 19.0     | 17.2     | 19.7     | 19.2        | 14.0 per cent |
| Chlorine Calc. as NaCl                                    | 36.5     | 23.7     | 47.3     | 31.3     | 28.3     | 32.4     | 31.6        | 23.0 per cent |
| Ratio $\frac{\text{Ash}}{\text{NaCl}}$ .. ..              | 2.7      | 4.2      | 2.1      | 3.1      | 3.2      | 3.0      | 3.1         | 4.6           |
| Ratio $\frac{\text{Ash} \times 100}{\text{S.N.F.}}$ .. .. | 11.1     | 7.9      | 13.9     | 8.4      | 8.3      | 8.8      | 9.0         | 8.3           |
| Freezing Point .. ..                                      | -0.545°C | -0.545°C | -0.560°C | -0.552°C | -0.550°C | -0.550°C | -0.550°C    | -0.555°C      |
| Composition of S.N.F.                                     |          |          |          |          |          |          |             |               |
| Milk Sugar .. ..  | 38.8     | 55.8     | 35.2     | 55.0     | 51.4     | 53.2     | 51.1        | 52.8 per cent |
| Proteids .. ..  | 50.0     | 30.2     | 47.8     | 36.5     | 40.2     | 37.9     | 39.5        | 37.8 per cent |
| Ash .. ..   | 11.1     | 7.9      | 13.9     | 8.4      | 8.3      | 8.8      | 9.0         | 8.3 per cent  |

BY J. B. HENDERSON, F.I.C., AND L. A. MESTON.

## HERD B.—(2 COWS.)

| Cows.  | 1        | 2         | Mixed Milk. | Normal Milk.  |
|--|----------|-----------|-------------|---------------|
| Yield.   | 2 quarts | 1.5 pint. |             |               |
| Total Solids ..                                      | 12.4     | 10.9      | 12.2        | 12.9 per cent |
| Fat .. ..  | 4.0      | 3.8       | 4.0         | 4.0 per cent  |
| Solids not fat ..                                    | 8.4      | 7.1       | 8.2         | 8.9 per cent  |
| Ash .. ..  | 0.73     | 0.75      | 0.73        | 0.75 per cent |
| Nitrogen .. ..                                       | 0.48     | 0.55      | 0.49        | 0.52 per cent |
| Chlorine in Ash ..                                   | 19.0     | 31.9      | 21.0        | 14.0 per cent |
| Chlorine Calc. as NaCl                               | 31.3     | 51.1      | 34.6        | 23.0 per cent |
| Ash  |          |           |             |               |
| Ratio $\frac{\text{NaCl}}{\text{Ash} \times 100}$ .. | 3.1      | 1.9       | 2.8         | 4.6           |
| Ratio $\frac{\text{S.N.F.}}{\text{S.N.F.}}$          | 8.7      | 10.5      | 8.9         | 8.3           |
| Freezing Point ..                                    | -0.54°C  | -0.54°C   | -0.54°C     | -0.555°C      |
| Composition of S.N.F.                                |          |           |             |               |
| Milk Sugar ..  | 54.8     | 40.0      | 52.9        | 52.8 per cent |
| Proteids ..  | 36.4     | 49.4      | 38.1        | 37.8 per cent |
| Ash .. ..  | 8.3      | 10.5      | 8.9         | 8.3 per cent  |

These results clearly show that the samples originally received, while below the legal minimum standard at which milk may be sold, had not been adulterated by the addition of added water.

The causes of the abnormality seem to have been similar in each case. In each, the cows got most of their food by grazing on the roads and vacant lands in their vicinity, and although the dairies were nearly two miles apart, the soil in the district is very poor, and the grass, therefore, probably poor in both quantity and quality. The food supply of the cows may therefore be safely taken as having been below normal.

Most of the cows were nearing the end of their period of lactation which is recorded as the period when "salty" milk is generally noted.

The inspector reported that cow No. 3 in Herd "A" was obviously sick.

The only cow giving milk which could be classed as normal was No. 2 of Herd "A."

The striking feature of these results is that from eight cows, seven of them being apparently in good health, only one cow gives milk which is normal. All the others

are abnormal, particularly in the high proportion of chlorine present. But by far the most striking feature of these results is that although the milks vary so far from the normal in chemical composition, the freezing point is practically normal throughout. The mammary glands of the cow, when unable to obtain the correct proportion of milk, sugar and other foodstuffs, adjust the osmotic pressure by adding an extra proportion of common salt from the blood.

It is evident from the amount of work which has been done by many workers in this direction, and the cases quoted give further proof, that certain organs of secretion work at definite osmotic pressures. This pressure is practically a constant the variation being within extremely narrow limits. In the case of milk from the cow, the variation measured by the well known Freezing Point method lies between  $-0.54^{\circ}\text{C}$ . and  $-0.56^{\circ}\text{C}$ . This is the first case in many tests where we have found the Freezing Point of an undoubtedly genuine milk to be higher than  $-0.55^{\circ}\text{C}$ . Still an extremely rare variation of  $0.01^{\circ}\text{C}$ . from the normal is not serious in the use of the Freezing Point as a factor in milk analysis.

It cannot be too strongly impressed on milk analysts that the mammary glands of the cow work almost entirely to a constant osmotic pressure, the constituents which produce the pressure varying according to the nature and amount of the food supply and also according to the period of lactation. So far as it is at present known there is no other constant controlling factor. We found exactly the same osmotic pressure (measured by the Freezing Point) in genuine milks which varied between 6.4 per cent solids not fat with 2.8 per cent fat and 9.7 per cent solids not fat with 5.6 per cent fat. The fact of the osmotic pressure being the one steady controlling factor in milk production having been definitely established, it is obviously absurd to continue judging the purity of a milk from the determination of factors which are variant and not constants. As the determination of the Freezing Point gives an easy and accurate method of measuring the osmotic pressure, the Freezing Point is obviously the constant factor which should be used in judging the purity of milk.

Fortunately in Australia we not only insist on purity of milk but on quality, and milk is not allowed to be sold from a cow which has to adjust the osmotic pressure with an extra proportion of common salt or to keep itself warm in the absence of sufficient food or shelter by consuming fat which should have gone into the milk. It is therefore necessary to determine the ordinary factors, fat, solids not fat etc., but these are not used and should not be used in determining the purity of the milk.

We put these analyses on record to once more emphasise the fact which we have previously noted (Proceedings of the Australasian Association for the Advancement of Science, Vol. XII., page 160 and Vol. XIII., page 88, and the Proceedings of the Royal Society of Queensland, Vol. XXIV., page 165), that the determination of the Freezing Point of a milk is not only the most important factor to determine in milk analysis, but is the only factor which definitely settles whether or not water has been added to the milk, and is the only one which gives a close approximation to the proportion of water which has been added.

In the case of the two samples recorded the sellers, if judged by the old solids-not-fat standard, would certainly have been convicted for selling milk adulterated with water. As it was they were not prosecuted but action was taken by the Health Department to prevent the further sale of these abnormal milks to the general public.

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# FURTHER NEW GENERA AND SPECIES OF AUSTRALIAN PROCTOTRYPOIDEA

By **ALAN P. DODD.**

(*Read before the Royal Society of Queensland, November  
9th, 1914.*)

DURING the present year, I have been enabled to collect Micro-Hymenoptera in various parts of Queensland and New South Wales, and have thus acquired numerous new species, besides extending the known range of many other species. I have also a small collection kindly given by Mr. W. W. Froggatt, Government Entomologist of New South Wales. While in Sydney I had the pleasure of looking through the collections of the Macleay Museum, describing a few species from its material. I have to thank the Curator, Mr. J. Shewan, for his kindness in assisting me with my work.

Still further species have been added from the well-worked locality of Gordonvale (late Nelson), North Queensland, by Mr. A. A. Girault and myself.

Unless otherwise specified, the magnification used was  $\frac{2}{3}$  inch objective, 1 inch ocular, Bausch and Lomb.

Family SCELIONIDÆ.

Subfamily Scelioninæ.

Genus MALLATELEIA, Dodd.

**MALLATELEIA FÖRSTERI.** *sp. nov.*

♂ Length, 1.70 mm.

Brownish yellow, the head black, the scutum, scutellum, and abdomen (except 3rd segment), dusky black, the femora slightly dusky.

Structure very similar to *ashmeadi* Dodd, but the punctures on the scutum and scutellum, are smaller and more dense. First abdominal segment striate, the rest smooth. Forewings somewhat infuscated, the margins distinctly not equally inclined. Antennæ as in *ashmeadi*.

*Hab*: New South Wales (Upper Tweed River). Described from one male caught by sweeping in open forest, 1000 feet. 17th May, 1914 (A. P. Dodd).

*Type*: South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

Dedicated to Arnold Förster.

*MALLATELEIA WESTWOODI*, sp., nov.

♂ Length, 1.95 mm.

Black; femora, tibiæ and antennal scape, fuscous; tarsi yellow. Head transverse, with fine scaly sculpture and moderately dense, not large, thimble punctures, also short fine white pubescence; eyes large, bare. Thorax slightly longer than wide; scutum and scutellum with similar sculpture to the head; parapsidal furrows distinct and complete. Abdomen a little longer than the head and thorax united, a little wider than the thorax; the segments all more or less wider than long; 1st striate; the 2nd with striæ far laterad smooth and glabrous mesad; 3rd as long as following united, practically smooth mesad, then with very fine scaly sculpture; the remaining segments wholly finely sculptured. Forewings long; rather broad; almost hyaline; cephalic and caudal margins about equally inclined; discal cilia fine, exceedingly dense. Pedicel short, a little longer than wide; 1st funicle joint a little longer, the 2nd quadrate, the 3rd longer than 2nd, but shorter than 1st; 3-9 subequal.

*Hab*: North Queensland (Pentland, 200 miles west of Townsville). Described from one male caught by sweeping in forest, September, 1914 (A. A. Girault).

*Type*: In the Queensland Museum, Brisbane, a ♂ on a tag, antennæ and forewings on a slide.

Dedicated to John Obadiah Westwood.

## AUSTROSCELIO. New genus.

♂ ♀ Of stout form, very much resembling *Hadronotus* Förster, but more especially *Hadronotoides* Dodd.

Head very transverse: eyes large, hairy: ocelli very wide apart, the lateral ones touching the eye margins; viewed from in front the head is somewhat wider than long: antennal depression very profound, occupying almost all lower two-thirds of face. Thorax scarcely longer than wide: convex: scutum large, without furrows; scutellum very large, projecting over and hiding the metanotum, bidentately emarginate at apex: postscutellum with a blunt tooth. Abdomen broadly sessile: a little longer than the head and thorax united: one-half longer than wide: pointed at apex: slightly convex above, straight beneath, first segment very transverse, the second much the longest, occupying nearly one-half of surface. Forewings reaching apex of abdomen, broad: submarginal vein rather distant from the costa which it joins about middle of wing: marginal vein very short, the stigmal moderately long and oblique: postmarginal not developed. Antennæ 12-jointed in both sexes, in the female with a 6-jointed club, in the male filiform, the joints all longer than wide.

*Type*: AUSTROSCELIO NIGRICOXA (Dodd).

s. *Sparasion australicum* Dodd, Entomological News, Philadelphia, U.S.A., Vol. XXV, June, 1914, p. 255-6.

*Sparasion nigricoxa*, Dodd. Trans. Royal Soc. of S.A., Vol. XXXVIII, May, 1914, p. 123.

Originally described as a species of *Sparasion*: the description was misleading, since there is no frontal ledge on the face, and the general structure of the species excluded it. The specific characters given for *nigricoxa* do not hold, hence one name must fall. The female has not been recorded, but two have been found, one from the type locality of Gordonvale, the other being caught by sweeping in forest, Pentland, 200 miles west of Townsville, N.Q., September, 1914. (A. A. Girault).

♀ Antennal funicle suffused red, rest of antennæ black; scape slender, as long as next six joints combined; pedicel nearly twice as long as wide, first funicle joint a little narrower than pedicel, twice as long as wide. 2nd quadrate, 3rd and 4th transverse: club joints 1-5 transverse, 1st small, 2nd the largest.

*AUSTROSCELIO ROBUSTUS, sp. nov.*

♀ Length, 2.50 mm.

Coal black; legs (except coxæ) reddish yellow; scape and pedicel almost black; next four joints golden yellow.

Head coarsely rugulose; ocelli wide apart, the lateral pair almost touching the eye margins; eyes rather densely pubescent. Thorax scarcely longer than wide; scutum and scutellum rather coarsely rugulose; parapsidal furrows not evident. Abdomen no wider than thorax, one-half longer than wide, 2nd segment occupying about one-half of surface; abdomen wholly longitudinally rugose. Forewings reaching apex of abdomen; broad; somewhat infuscated; submarginal vein attaining costa about middle of wing; stigmal rather short, rather oblique: venation yellowish. Antennæ 12-jointed; scape moderately long and slender; pedicel almost twice as long as wide; 1st funicle joint slightly shorter and narrower than pedicel; 2-4 wider than long; club plainly 6-jointed, joints 1-5 distinctly wider than long, 2nd slightly the widest.

*Hab*: New South Wales. Described from two females in the collection of the Macleay Museum.

*Type*: Macleay Museum, Sydney: Hymenoptera 2D, a ♀ on a tag, the antennæ on a slide.

Very similar to the type species, *nigrocoxa* Dodd.

*Genus PLASTOGRYON, Kieffer.*

*PLASTOGRYON UNICOLOR, Dodd.*

One female sweeping in forest, Childers, South Queensland, 25th June, 1914 (A. P. Dodd).

*PLASTOGRYON ELEGANS, sp. nov.*

♀ Length, 1.10 mm. Of slender form.

Black, the basal two-thirds of abdomen orange yellow; and antennal scape golden yellow.

Head quadrate. Thorax distinctly longer than wide ; finely polygonally sculptured. Abdomen as long as head and thorax united, over twice as long as wide . 1st segment striate ; 2nd occupying one-half of surface. polygonally reticulate. Pedicel over twice as long as wide ; 1st funicle joint much shorter and narrower than pedicel, nearly twice as long as wide. Forewings reaching well beyond apex of abdomen ; moderately broad, hyaline : discal cilia moderately coarse and dense : marginal vein no longer than the stigmal, the latter curved caudad somewhat at apex : postmarginal twice as long as the marginal.

*Hab* : South Queensland (Childers). Described from one female caught by sweeping in forest. June 25th. 1914 (A. P. Dodd).

*Type* : South Australian Museum. ♂ ♀ on a slide.

*Genus* HOPLOTELEIA, *Ashmead*.

HOPLOTELEIA NIGRICORNIS *Dodd*.

A male and female caught on foliage of plants, etc., round canefields, Halifax, Herbert River. North Queensland, 29th March, 1914 (A. P. Dodd). The male antennæ agree with those of *australica*, Dodd.

HOPLOTELEIA SCULPTURATA, *sp. nov.*

♀ Length. 4.10 mm.

Coal black ; legs (including coxæ). and first three funicle joints of antennæ. bright reddish yellow.

Head and thorax coarsely rugulose, the rugosity of the scutum shallower, the scutum also densely, finely granulate. Lateral ocelli separated from each other by twice their own diameter. Thorax no wider than the head, distinctly longer than wide. Abdomen as long as head and thorax united. its apex truncate, with two very short spines ; first two segments striate. the rest longitudinally rugulose, the 3rd distinctly the longest. Body pubescent, the hairs rather coarse. Forewings and antennæ as described for *australica* Dodd.

*Hab* : New South Wales (Chindera, Tweed River). Described from one female caught by sweeping in forest, 12th May, 1914 (A. P. Dodd).

*Type*: South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

*HOPLOTELEIA AUSTRALICA OCCIDENTALIS. new variety.*

♂ Length. 2.65 mm.

Similar to *austratica* Dodd but the scape is bright yellow, the pedicel and basal funicle joints suffused with yellow.

*Hab*: West Queensland (Cloncurry). Described from one male caught by sweeping in open forest, 18th April, 1914 (A. P. Dodd).

*Type*: South Australian Museum, a ♂ on a tag.

*HOPLOTELEIA PERSIMILIS, sp., nov.*

♂ Length. 2.65 mm.

Very similar to *austratica* but the antennal scape is red at base: the funicle joints are longer, all distinctly longer than wide: the marginal vein is over one-third as long as the stigmal, the latter slightly curved caudad at apex; and the hind tarsi are very long, as in *nigricornis*.

*Hab*: North Queensland (Halifax, Herbert River). Described from one male captured with the above mentioned specimens of *nigricornis*.

*Type*: South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

*HOPLOTELEIA ACREISCAPUS, sp. nov.*

♀ Length, 2.90 mm.

Very similar to *austratica* but the coxæ yellow, also, the antennal scape, the pedicel and funicle slightly suffused yellowish; the abdomen pointed at apex: scutum and scutellum with only very scattered pubescence (in *austratica* rather dense on scutellum and caudal portion of scutum); marginal vein almost one-half as long as the stigmal, which is rather more oblique; hind tarsi long and slender.

*Hab*: North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping on edge of jungle, January, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum. ♂ & ♀ on a tag, the antennæ and forewings on a slide.

*HOPLOTELEIA AUSTRALICA*. *Dodd*.

Four females, one male, sweeping in forest, Pentland, 200 miles west of Townsville. September, 1914 (A. A. Girault).

*HOPLOTELEIA GRACILICORNIS*, *sp. nov.*

♀ Length, 3.30 mm.

Very similar to *sculpturata* Dodd but smaller; the abdomen acute at apex; the thorax with only scattered pubescence, all pubescence much finer; antennæ wholly black, more slender than in *sculpturata*, the 1st funicle joint over twice as long as wide (not twice as long as wide in *sculpturata*). Otherwise the same, or nearly.

*Hab*: New South Wales (Glen Innes, 4,500 feet). Described from one female received from Mr. W. W. Froggatt and labelled "Glen Innes, A. M. Lea."

*Type*: In the collections of Mr. W. W. Froggatt, Government Entomologist of New South Wales, a female on a tag, the antennæ and forewings on a slide.

*Genus TRICHOTELEIA*. *Kieffer*.

*TRICHOTELEIA ARGENTIPES*, *sp. nov.*

♀ Length. 4.25 mm.

Black: abdomen brownish in centre; legs (including coxæ) and antennal scape, silvery yellow.

Head transverse-quadrate: eyes large, bare: ocelli large, the lateral ones further from each other than from the median ocellus, and almost touching the eye margins. Vertex caudad of lateral ocelli irregularly subtransversely striate: in front of lateral ocelli, longitudinally foveate; lower half of frons, transversely striate: antennæ separated by a distinct carina; the head (except lower half of face) with scattered small punctures: occiput concave. Thorax nearly one-half longer than wide. Pronotum not visible; scutum finely granulate, and with numerous setigerous thimble-punctures: parapsidal furrows deep and distinct,

wide apart, almost parallel; scutellum smooth except for a few minute punctures: metathoracic caudal angles acute, the metanotum laterally with a patch of white pubescence. Abdomen twice as long as head and thorax united; 1st segment almost twice as long as wide, longitudinally striate, with a blunt horn projecting over and against centre of metanotum, the horn transversely striate at apex; 2nd segment somewhat longer than 1st, longitudinally striate, except near the carinated margins, where dense setigerous thimble-punctures prevail; 3rd shorter than 2nd, granulate in centre, laterad of this striate, and the lateral area of punctures wider; 4th one-half length of 3rd, granulate in centre, then with the dense thimble punctures; 5th as long as 4th, wholly granulate, except for scattered punctures; 6th forming a straight projection, a little longer than two preceding segments united, granulate, and with numerous setigerous punctures. Forewings reaching to apex of 6th abdominal segment: broad: somewhat infuscated; discal cilia moderately fine, very dense: submarginal vein attaining costa about middle of wing: marginal one-half as long as the stigmal, which is long, very oblique, its apex slightly curved caudad: postmarginal very long, several times as long as the stigmal: basal vein very distinct, very oblique, over one-half longer than the stigmal: median not indicated. Pedicel nearly twice as long as wide: 1st funicle joint twice as long as pedicel; 2nd slightly longer than 1st: 3rd a little shorter: 4th distinctly shorter than 3rd: 5th shorter than 4th: but distinctly longer than wide: club slender, 5-jointed: 1st the longest and widest, longer than wide, 2-4 quadrate.

*Hab*: North Queensland (Halifax, Herbert River). Described from numerous females captured on a decayed log in jungle, 6th April, 1914 (A. P. Dodd).

*Type*: South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

*TRICHOTELEIA ACUTIVENTRIS*, *sp. nov.*

♀ Length, 3.20 mm.

Very similar to *nigricincta* Dodd, but the orange coloration of the body is much deeper, the abdomen not being noticeably margined with black, only darker along the

margins: medium lobe of scutum almost wholly black; antennal pedicel and funicle slightly suffused yellowish: head more transverse, the ocelli further apart, the lateral ones further distant from each other than from the median one: head, scutum and scutellum almost smooth, with only a very few scattered pin-punctures (punctures larger and much more dense in *nigricincta*): thorax stouter, the parapsidal furrows distant at posterior margin of scutum by half their own length (distinctly less than half their own length in *nigricincta*): 1st abdominal segment shorter than either 2nd or 3rd, the 7th pointed and longer than two preceding, in both species: segments 5-7 with thimble-punctures: forewings with a more or less obscure median longitudinal band, the rest slightly infuscated: marginal vein fully one-half as long as the stigmal, the postmarginal twice as long as stigmal: funicle joints somewhat stouter, the 1st a little longer than pedicel. abdomen over twice as long as head and thorax united.

*Hab*: North Queensland (Harvey's Creek, near Cairns). Described from one female caught by sweeping in jungle, 2nd August, 1914 (A. P. Dodd).

*Type*: South Australian Museum. a ♀ on a tag, antennæ and forewings on a slide.

*Genus* MACROTELEIA, *Westwood*.

MACROTELEIA APICALIS, *sp. nov.*

♂ Length, 4.25 mm. Long and slender.

Golden or orange yellow, the eyes and ocelli black; vertex of head, horn on basal abdominal segment, and apical fourth of abdomen, sooty black: antennal club black.

Head no wider than thorax, with scattered circular punctures: eyes large, bare: lateral ocelli touching the eye margins. Thorax nearly twice as long as wide: scutum and scutellum sculptured like the head, the punctures setigerous: pronotum distinctly visible on the sides; parapsidal furrows deep and distinct. Abdomen over twice as long as head and thorax united; sessile, the apical segments compressed laterally: wholly striate; the segments all longer than wide, the 3rd slightly longer than

2nd or 4th. the 1st segment with a blunt horn at base. Forewings barely reaching apex of 4th abdominal segment; slightly infuscated: discal cilia moderately fine and dense; submarginal vein attaining costa about middle of wing; marginal vein over one-half longer than the stigmal, the latter short. scarcely oblique; postmarginal nearly twice as long as marginal: venation thick and distinct. Pedicel long. over twice as long as greatest width. the 1st funicle joint slightly longer and narrower, nearly four times as long as wide; 2nd not twice as long as wide, the 4th wider than long: club rather slender. 6-jointed. 1st joint largest, almost as long as wide.

*Hab*: North Queensland (Halifax. Herbert River). Described from one female caught on foliage of plants round canefield, 29th March. 1914 (A. P. Dodd).

*Type*: South Australian Museum. a ♀ on a tag, antennæ and forewings on a slide.

*MACROTELEIA DISTINCTA* sp. nov.

♀ Length, 3.75 mm.

Black; legs (including the coxæ) and first six antennal joints golden yellow.

Head subquadrate: densely punctate; eyes large, bare; ocelli large, the lateral ones almost touching the eye margins. Thorax one-half longer than wide; scutum and scutellum densely confluent punctate. the punctures moderately small; parapsidal furrows distinct; *post-scutellum with a rather large bidentate spine mesad*. Abdomen one half longer than the head and thorax united; sessile, slightly fusiform; 2nd and 3rd segments largest; wholly longitudinally striate and pubescent. Thorax also densely pubescent. Forewings reaching almost to apex of abdomen; broad: almost hyaline: marginal vein slightly longer than the stigmal, which is moderately short and oblique, straight; postmarginal twice as long as the marginal; venation clear golden yellow. Pedicel fully twice as long as wide: first funicle joint two-thirds longer than pedicel; 2nd slightly longer than pedicel: 3rd shorter: 4th quadrate; club 6-jointed.

♂ Scape yellow. rest of antennæ black : pedicel slightly longer than wide : 1st funicle joint longer, almost twice as long as wide : 2nd and 3rd shorter : 4-9 quadrate.

*Hab* : New South Wales. Described from one pair in the Macleay Museum and labelled "New South Wales."

*Types* : In the Macleay Museum. Sydney. Hymenoptera 6D, the above specimens on two tags. antennæ and forewings on a slide.

*Genus* PLATYTELEIA, *Dodd*.

PLATYTELEIA LATIPENNIS. *Dodd*.

One female captured from foliage of plants around canefields. Halifax, Herbert River, N.Q., 29th March, 1914 (A. P. Dodd).

*Genus* HADRONOTOIDES, *Dodd*.

HADRONOTOIDES PENTATOMUS. *Dodd*.

In the collections of the Government Entomologist of Queensland, Mr. Henry Tryon, there are several specimens of this species, bred from pentatomid eggs, Kelvin Grove, Brisbane. Formerly the species had been known from several North Queensland localities.

HADRONOTOIDES MERIDIANUS. *sp. nov.*

♀ Length. 2.25 mm.

Coal black : legs (except cephalic coxæ) clear golden yellow : antennal scape yellow at base, dusky at apex.

Head transverse, slightly wider than thorax ; rugose punctate : eyes large ; ocelli wide apart, the lateral ones distant from the eye margins by nearly their own diameter. Thorax scarcely longer than wide ; coarsely rugulose ; scutellum large, rather deeply bidentate. Abdomen as wide as thorax, no longer than wide : 1st segment striate, rest longitudinally rugose ; first three segments subequal. Forewings extending well beyond apex of abdomen ; broad ; hyaline ; discal cilia rather coarse and dense ; submarginal vein attaining costa about middle of wing ; marginal vein fully one-half as long as stigmal, which is

moderately long, rather oblique; postmarginal fully twice as long as stigmal. Antennæ 12-jointed; pedicel long and slender, almost twice as long as wide; 1st funicle joint slightly longer than pedicel; 2nd as wide as long; 3rd wider than long; club probably 6-jointed (the 3rd and 4th funicle joints appear to form part of club, as in *pentatomus*). joints 1-5 distinctly wider than long, 2nd the largest.

♂ Pedicel short and stout; 1st funicle joint twice as long as pedicel, fully twice as long as wide; 2nd shorter; but distinctly longer than wide; 4-9 subquadrate, gradually narrowing towards apex.

*Hab*: South Australia. Described from two males, one female in the Macleay Museum, and labelled "South Australia."

*Types*: In the Macleay Museum, Sydney, Hymenoptera 3D, the above specimens on a tag, ♂ and ♀ antennæ and forewings on a slide.

*HADRONOTOIDES RETICULATUS, sp. nov.*

♀ Length, 1.55 mm.

Coal black; the legs (except the coxæ), reddish yellow.

In general appearance and structure very similar to *pentatomus*.

Head, scutum and scutellum rather coarsely rugulose and with fine pubescence; eyes hairy; scutellum not so large as in the two other species, almost semicircular, not so deeply bidentate at apex. Abdomen somewhat longer than wide; first segment striate; the second with a row of deep foveæ at base; rest of abdomen with fine, rather dense, irregularly longitudinal reticulation. Pedicel one-half longer than wide, the first funicle joint as long and slightly narrower, the second a little wider than long; 4th distinctly widened to form part of club. Marginal vein one-half as long as the long stigmal. Otherwise about as in *pentatomus*.

*Hab*: North Queensland (Pentland, 200 miles west of Townsville). Described from two females caught by sweeping in forest, September, 1914 (A. A. Girault).

*Types*: In the Queensland Museum, Brisbane, two ♀s on a tag, antennæ and forewings on a slide.

*Genus HADRONOTUS, Færster.**HADRONOTUS NIGRICOA, Dodd.*

Two females captured from foliage of plants around canefields, Halifax, Herbert River, N.Q., 29th March, 1914 (A. P. Dodd.)

*HADRONOTUS AQUATICUS, Dodd.*

One male caught by sweeping in forest, Gordonvale, N.Q., 13th August, 1914 (A. A. Girault).

*Genus SCELIOMORPHA, Ashmead.**SCELIOMORPHA MAGNICLAVA, sp. nov.*

♀ Length, 3.75 mm.

Coal black; legs golden yellow, including the coxæ; first five antennal joints slightly suffused with yellow.

Head no wider than thorax; rugose-punctate, the punctures of moderate size; ocelli in an equilateral triangle, the lateral pair distant from the eye margins by nearly their own diameter. Thorax scarcely longer than wide; scutum with rather large, circular punctures, rather dense, the spaces between the punctures finely scaly; scutellum with large scattered punctures, the surface otherwise glabrous; parapsidal furrows complete; scutellum large. Abdomen sessile, scarcely as wide as the thorax; as long as the head and thorax combined; 2nd segment slightly the largest; 1st segment with six strong striæ centrally, rest of abdomen densely longitudinally rugose. Forewings reaching apex of abdomen; broad; infuscated; discal cilia rather fine, very dense; submarginal vein attaining costa about middle of wing; stigmal vein moderately long, not very oblique, straight; venation golden yellow. Antennæ 12-jointed; scape equal to next five joints combined; pedicel nearly twice as long as wide; funicle joints slightly narrower than pedicel; 1st one-half longer than wide; 2nd and 3rd wider than long; 4th widened, and probably forming part of club; club 6-jointed, 1st joint the longest and widest, as long as wide, 2-5 twice as wide as long.

*Hab*: New South Wales. Described from one female in the collections of the Macleay Museum.

*Type*: Macleay Museum, Sydney; Hymenoptera 1d. a ♀ on a tag, the antennæ and forewings on a slide.

SCELIOMORPHA NIGRICLAVA, *sp. nov.*

♀ Length, 4.75 mm.

Like *magniclava* but considerably larger; thorax one-half longer than wide, abdomen longer, somewhat longer than head and thorax combined; lateral ocelli almost touching the eye margins; scutum with larger punctures, the spaces between glabrous, scutellum sculptured like the scutum, but with an area centrally smooth except for a few pin-punctures: first six antennal joints golden yellow, the 1st funicle joint as long and as wide as the pedicel; club not so wide, the 1st club joint a little wider than long; forewings rather less infuscated.

*Hab*: New South Wales. Described from one female with *magniclava*.

*Type*: Macleay Museum, Sydney; Hymenoptera SD. a ♀ on a tag, the antennæ and forewings on a slide.

SCELIOMORPHA CONCOLORIPES, *sp. nov.*

♀ Length, 3.25 mm.

Very similar to *magniclava*, but the coxæ, femora, and tibiæ are black (except at the knees); the scutellum has the fine, scaly sculpture, as well as the punctures, the venation is rather darker; pedicel only one-half longer than wide; 1st funicle joint as long and as wide as pedicel; club narrower, as in *nigriclava*.

*Hab*: New South Wales. Described from one female with the two preceding species.

*Type*: Macleay Museum, Sydney; Hymenoptera SD; a ♀ on a tag, the antennæ and forewings on a slide.

SCELIOMORPHA ATRICOXA, *sp. nov.*

♂ Length, 4.40 mm. With the habitus of the genus *Scelio*.

Very similar to *nigriclava* but thorax not one-half longer than wide; abdomen distinctly longer than head and thorax united; scutum and scutellum wholly densely punctate, and with fine, scaly sculpture; abdomen rugose punctate (except 1st segment); coxæ black; apex of stigmal vein curved distinctly caudad. Scape and pedicel

yellow, rest of antennæ black; pedicel twice as long as wide; subequal to 2nd funicle joint, the 1st distinctly longer.

*Hab.* New South Wales (Elizabeth Bay, Sydney). Described from one male with the preceding species.

*Type*: Macleay Museum, Sydney: Hymenoptera 11D, a ♂ on a tag, the antennæ and forewings on a slide.

*Genus* DICROTELEIA. *Kieffer.*

DICROTELEIA SOLITARIA, *sp. nov.*

♀ Length, 4.40 mm.

Shining black: legs (including coxæ) and antennal scape, golden yellow.

Head subquadrate, with large circular punctures, the surface with a dull opaqueness; eyes large, bare; ocelli large, in an equilateral triangle, the lateral ones touching the eye margins. on the occiput, the punctures form transverse rugose punctation. Thorax nearly twice as long as wide, the pronotum not visible from above; scutum sculptured like the head, the punctures in irregular transverse rows separated by ridges; punctures less dense on scutellum. Parapsidal furrows deep, distinct, the median carina of scutum conspicuous and corresponding to a median carina on the scutellum; postscutellum almost square. Abdomen one-half longer than the head and thorax united; no wider than thorax: sessile, the apex pointed: 1st segment with a blunt prominence; first four segments longitudinally rugose; the apical two with scattered punctures; 2nd and 3rd the longest, subequal, distinctly longer than wide. Body with inconspicuous pubescence. Forewings reaching to middle of 5th abdominal segment; broad; infuscated; discal cilia rather coarse and dense; venation fuscous, as in the Australian species of *Sceliomorpha* Ashmead, the stigmal vein long and oblique: marginal punctiform; submarginal rather remote from costa; no other veins. Pedicel one-half longer than wide; 1st funicle joint distinctly longer; 2nd as long as pedicel, 3rd shorter; 4th as wide as long; club 6-jointed, 1st joint largest, as long as wide; 2-5 wider than long.

*Hab* : North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in jungle, 20th June, 1914 (A. A. Girault).

*Type* : South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

This species appears to agree with Kieffer's diagnosis of the genus (subgenus of Kieffer). In general appearance and structure it resembles the Australian species of *Hoplosteleia* Ashmead. The type and only other species of the genus, *Oxytelio* (*Dicroteleia*) *rugosa* Kieffer comes from Java.

*DICROTELEIA GLABRISCUTELLUM, sp. nov.*

♀ Length. 2.95 mm.

Coal black ; legs (including coxæ) bright golden yellow, also the pedicel and first three funicle joints, the scape distinctly darker.

Head transverse : the face with large, not very close, shallow punctures, some of these on the vertex joining and forming irregular transverse rugosity ; no wider than the thorax ; eyes very large, bare ; ocelli large, separated from the eye margins by half their own diameter. Thorax somewhat longer than wide ; scutum large, with large, rather close, shallow punctures, these setigerous ; parapsidal furrows distinct, also a distinct median carina present ; scutellum large, smooth, shining, except for a few scattered indefinite pin-punctures, these more distinct laterad ; post-scutellum small, quadrate ; metanotum very short at meson. Abdomen broadly sessile ; as long as the head and thorax combined, slightly narrower than the thorax ; the segments all more or less wider than long, the 2nd the largest, a little longer than the 3rd ; 1st striate, the 2nd and 3rd with large, shallow, rather close punctures divided into rows by longitudinal striæ, the 4th and 5th without the striæ and with the punctures setigerous. Forewings reaching apex of abdomen, broad : infusate ; submarginal vein attaining costa about middle of wing ; stigmal vein very long and oblique, its apex curved slightly caudad ; venation golden yellow. Antennæ 12-jointed ; scape long and slender ; pedicel over twice as long as wide, the first funicle joint

slightly shorter; 2-4 wider than long, the 4th somewhat widened; club rather compact, first joint as long as wide, 2-5 much wider than long.

*Hab*: North Queensland (Harvey's Creek, near Cairns). Described from two females caught on foliage of plants in jungle country, 12th October, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

The species *Sceliomorpha rugulosa*, Dodd, *S. hyalini-pennis*, Dodd, *S. montana*, Dodd, and *S. nigricoxa*, Dodd, must be included here, since they possess the median carina on the scutum, and the quadrate postscutellum. These four and *glabriscutellum* are closely related, but *solitaria* is very distinct. The species of *Sceliomorpha* described in this paper, will probably fall here, but at present the types are not accessible to me.

*Genus* BARYCONUS. Færster.

BARYCONUS DELICATULUS, *sp. nov.*

♀ Length, 1.75 mm. Slender.

Black; the trochanters, knees, tibiæ and tarsi testaceous.

Head subquadrate, quite smooth. Thorax distinctly longer than wide; narrowed anteriorly; scutum as long as wide, the parapsidal furrows well defined; scutum and scutellum with polygonal scaly sculpture, not very fine. Abdomen twice as long as head and thorax united; distinctly petiolate; the apical two segments produced into a narrow point; 1st segment with a distinct horn, longer than wide; 2nd and 3rd segments longest; 1st and 2nd striate, the rest longitudinally reticulate. Forewings reaching almost to apex of abdomen; moderately narrow; hyaline, with an obscure band covering apical portion of submarginal, and all marginal veins, and a second obscure band covering almost apical third of wing; discal cilia fine, rather dense; submarginal vein attaining  $\cos^a$  about middle of wing; marginal vein two-thirds as long as the stigmal, the latter moderately long, oblique, quite straight; postmarginal over thrice as long as the stigmal; basal vein not indicated. Antennæ 12-jointed; pedicel twice as long

as wide ; 1st and 2nd funicle joints each subequal to pedicel ; 3rd a little longer than wide ; 4th quadrate ; club rather compact, 6-jointed, joints 1-5 about equal in length, 3rd slightly the widest.

*Hab* : South Queensland (Burnett Heads, Bundaberg). Described from one female caught by sweeping in forest, 20th June, 1914 (A. P. Dodd).

*Type* : South Australian Museum, a ♀ on a tag. antennæ and forewings on a slide.

*BARYCONUS DULCIS*, *Dodd*.

Numerous specimens caught on foliage of plants round canefields, Halifax, Herbert River, North Queensland, March, 1914 (A. P. Dodd).

*BARYCONUS VARIIPES*, *sp. nov.*

♀ Length, 1.55 mm. Of very slender form.

Bright golden or orange yellow : eyes, ocelli, femora, tibiæ (except the knees), horn on abdomen, a rather broad band at caudal half of second segment, and apical two-fifths of abdomen (from caudal thirds of third segment), black ; scutellum somewhat dusky.

Head subquadrate ; eyes moderate ; ocelli in a very obtuse-angled triangle. Thorax slender, twice as long as greatest width ; parapsidal furrows present for caudal two-thirds of scutum, approaching rather close together caudad : scutellum with a line of fine foveæ across its base. Abdomen slender ; somewhat longer than the head and thorax united ; no wider than the thorax ; 1st segment about twice as long as wide, with a blunt horn ; 2nd and 3rd also somewhat longer than wide, the 3rd a little the larger, the following segments combined about equal to length of 3rd. Head, scutum and scutellum with very fine polygonal scalysculpture ; the abdomen wholly longitudinally striate. Legs long and slender. Antennæ 12 jointed ; scape barely longer than next two joints united ; pedicel slender, fully two and a half times as long as wide ; first funicle joint a little shorter and narrower than the pedicel, nearly thrice as long as wide ; the others shortening, the 4th quadrate : club 6-jointed, 3-5 slightly the largest, all

transverse. Forewings very narrow, with two dark bands about as in *fasciatus*, the wing apex more lightly infuscate, and thus more or less hyaline; discal cilia very fine and dense; marginal cilia short.

*Hab*: North Queensland (Pentland, 200 miles west of Townsville). Described from one female caught by sweeping in forest, September, 1914 (A. A. Girault).

*Type*: In the Queensland Museum, Brisbane, a ♀ on a tag, the antennæ and forewings on a slide.

This species comes nearest to *fasciatus* Dodd. and *maculatus* Dodd but is at once distinguished by having much more black on the abdomen and legs. Of similar slender build to *fasciatus*, which is more slender than *maculatus*.

**BARYCONUS CITREUS, sp. nov.**

♀ Length, 1.60 mm. Stout and robust.

In my table of species (1914) running near *gloriosus* Dodd.

Golden yellow; eyes, ocelli, segments 2 and 4-8 of abdomen, and the antennæ (except the scape), black; scutellum and centre of scutum, brownish.

Head and thorax with fine polygonal scaly sculpture, pubescent. Lateral ocelli touching the eye margins. Thorax no longer than wide, the scutum large, the parapsidal furrows well defined, wide apart; postscutellum unarmed. Abdomen no longer than head and thorax combined, no wider than thorax. 1st and base of 2nd segments striate, the rest smooth: 3rd segment somewhat the longest; all segments wider than long; 1st segment without a horn. Forewings reaching apex of abdomen; rather broad; infuscated: discal cilia fine, very dense; submarginal vein attaining the costa about middle of wing; marginal vein almost one-half as long as the stigmal, the latter long, straight, scarcely oblique: postmarginal twice as long as the stigmal; basal vein rather distinct, oblique. Pedicel one-half longer than wide; 1st funicle joint slightly longer than pedicel: 2-4 shortening, the 4th transverse: club 6-jointed, compact, large, joints 1-5 transverse and of equal length, the 3rd slightly the widest.

*Hab*: South Queensland (Childers). Described from one female caught by sweeping in the open forest, 2nd July, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the head and forewings on a slide.

*Genus CREMASTOSCELIO, Dodd.*

*CREMASTOSCELIO FLAVIVENTRIS, sp. nov.*

♀ Length, 1.35 mm.

Head and thorax black; abdomen golden yellow, like the legs, its apex black; first four antennal joints yellow, next four slightly suffused with yellow, the club black.

Very similar in structure to the three other species in the genus, but the abdomen is more slender, distinctly longer than the head and thorax united. Mandibles 4 dentate; discal cilia not very fine, dense, in about 30 rows.

*Hab*: New South Wales (Upper Tweed River). Described from one female caught by sweeping foliage and grass in forest, 1,000 feet, 17th May, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a slide. Later another female was found labelled "Sweeping forest on hills, Maclean, Clarence River, N.S.W., 30th May, 1914 (A. P. Dodd)."

*Genus SCELIO Latreille.*

Table of Australian Species.

Males; females.

- |  |  |    |    |    |    |    |   |      |
|--|--|----|----|----|----|----|---|------|
| (1) Body wholly black  | ..   | .. | .. | .. | .. | .. | — | (4)  |
| Body more or less bright reddish or yellowish  | ..   | .. | .. | .. | .. | .. | = | (2)  |
| (2) Abdomen black  | ..   | .. | .. | .. | .. | .. | = | (3)  |
| Thorax and abdomen wholly red; female  | ..   | .. | .. | .. | .. | .. |   |      |
|  | = <i>cruentatus</i> sp. nov. (West Queensland)         |    |    |    |    |    |   |      |
| (3) Scutellum black; abdomen wholly striate  | ..   | .. | .. | .. | .. | .. |   |      |
|  | = <i>nigriscutellum</i> Dodd (North Queensland)        |    |    |    |    |    |   |      |
| Thorax uniformly red; 1st, 2nd, and 5th abdominal segments striate, 3rd and 4th polygonally reticulate; female |  |    |    |    |    |    |   |      |
|  | = <i>semisanguineus</i> , Girault (Northern Territory) |    |    |    |    |    |   |      |
| (4) Vertex of head with scattered punctures  | ..   | .. | .. | .. | .. | .. | = | (5)  |
| Vertex of head with large dense punctures  | ..   | .. | .. | .. | .. | .. | = | (9)  |
| Vertex of head reticulately rugose   | ..   | .. | .. | .. | .. | .. | = | (11) |

- (5) Coxæ and at least first three antennal joints yellow : females = (6)  
 Coxæ and all antennæ black .. .. . = (7)
- (6) Scutum and scutellum coarsely reticulately rugose, 1st and 2nd segments striate, 3rd reticulate, apex of 4th and all remaining segments hardly sculptured  
 = *pulchellus* Crawford (New South Wales)  
 Scutum and scutellum with large circular punctures; abdomen finely longitudinally striate = *fulgidus*, Crawford (New S. Wales)
- (7) Scutum and scutellum with large scattered punctures; legs almost wholly black; parapsidal furrows not indicated; female  
 = *varipunctatus*, Dodd (North Queensland)  
 Scutum and scutellum confluent or rugose punctate; legs (except coxæ) not black; parapsidal furrows indicated or distinct .. .. . = (8)
- (8) Scutum and scutellum rugose punctate; segments after 1st and 2nd finely longitudinally reticulate; male, female ..  
 = *parvicornis* sp. nov. (South Austr.)  
 Scutum and scutellum confluent punctate, the punctures varying in size; abdomen wholly striate, except for smooth median areas on segments 3-5; female .. .. .  
 = *diemenensis* sp. nov. (Tasmania)
- (9) Coxæ yellow; antennal scape and pedicel yellow; female..  
 = *puncticeps*, Dodd (North Queensland)  
 Coxæ black; antennæ wholly black .. .. . = (10)
- (10) Lower half of face striate; parapsidal furrows deep and distinct; abdominal segments 3-6 finely striate, the cross-striæ distinct; female .. .. .  
 = *striatifacies* sp. nov. (New South Wales)  
 Striæ on face only below insertion of antennæ; parapsidal furrows very faintly indicated; abdomen strongly striate, the cross-striæ not visible; male .. .. .  
 = *nigricoxa* Dodd (North Queensland)
- (11) Abdomen wholly longitudinally rugose or striate, except sometimes for smooth median areas .. .. . = (13)  
 Abdomen with most of the segments not longitudinally rugose or striate .. .. . = (12)
- (12) Coxæ and femora black, also the antennæ; wings hyaline; segments after first finely reticulately rugose; male ..  
 = *nigricornis* Dodd (North Queensland)  
 All legs yellow, also antennal scape and pedicel: wings not hyaline; segments 3-5 with fine close shallow punctures; female .. .. . = *chortoicetes* Froggatt (N. S. Wales)
- (13) Abdomen longitudinally rugose; male; female .. ..  
 = *froggatti* Crawford (East Q'land)  
 Abdomen longitudinally striate .. .. . = (14)
- (14) Coxæ black .. .. . = (15)  
 Coxæ yellow .. .. . = (18)

- (15) Femora black; rugosity of thorax with a distinct tendency to become longitudinal; scutellum with a median carina; female .. .. = *locustæ* sp. nov. (North Queensland)  
Femora not black; rugosity of thorax reticulate; scutellum without a median carina .. .. = (16)
- (16) Head, pronotum and sides of thorax with long, white pubescence; rugosity of head not very coarse; female .. .. = *pilosiceps* sp. nov. (New South Wales)  
Pubescence not long or very distinct, rugosity of head very coarse; males .. .. = (17)
- (17) Wings hyaline; abdomen finely striate, the 2nd and 3rd segments with median areas not striate, 4th distinctly longer than 3rd .. .. = *flavicornis* Dodd (N. Q'land)  
Wings not hyaline; a smooth area present at caudal two-thirds of 3rd segment mesad, 3rd distinctly longer than 4th. .. .. = *perplexus* sp. nov. (N. Q'land)
- (18) Head, pronotum, and sides of thorax with long whitish pubescence; female .. .. = *pilosus* Dodd (North Queensland)  
Pubescence not distinct or long .. .. = (19)
- (19) Third funicle joint of male antennæ much enlarged, longer than wide .. .. = (21)  
Third funicle joint of male antennæ not much enlarged, wider than long .. .. = (20)
- (20) Male; antennæ black; funicle joints 4-7 not or barely wider than long; stigmal vein as in *ori*, the stigmal spot on the distal side of stigmal and marginal veins .. .. = *orientalis* Dodd (North Queensland)  
Male; scape red, the antennæ becoming black towards apex; funicle joints 4-7 distinctly wider than long; stigmal vein straight, as in *australis*, the stigmal spot on both sides of marginal and stigmal veins = *affinis* sp. nov. (North Queensland)
- (21) Female antennæ wholly black; stigmal vein straight .. .. = *australis* Froggatt (East Q'land and N.S.W.)  
Female antennæ with at least first two joints yellow; stigmal vein slightly convexly curved .. .. = *ori* Girault (East Q'land and N.S.W.; West Q'land).

*SCELIO CRUENTATUS*, sp. nov.

♀ Length, 4.15 mm.

Bright red: head, apex of abdomen and last seven antennal joints, black.

Head and thorax coarsely rugose, the metanotum with longitudinal carinae or striæ, the abdomen wholly longitudinally striate. Head transverse, no wider than the thorax, the occiput concave: eyes bare. Thorax distinctly longer than wide, the parapsidal furrows deep and distinct. Abdomen a little longer than head and thorax united, fusiform

no wider than thorax. the 3rd segment slightly the longest. Forewings reaching almost to apex of abdomen; broad; rather darkly infuscated; venation not very distinct, the stigmal vein moderately long, scarcely oblique, straight; stigmal spot rather distinct, irregularly circular. Antennæ short and stout, the joints beyond the third all much wider than long; pedicel over twice as long as wide, slightly longer than 1st funicle joint. Metanotum with white pubescence laterally.

*Hab*: West Queensland (Cloncurry). Described from one female caught on ground, 18th April, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum. a ♀ on a tag. antennæ and forewings on a slide.

*SCELIO PARVICORNIS*, *sp. nov.*

♀ Length, 3.75 mm.

Black; legs reddish yellow, the coxæ black, the femora dusky, antennæ wholly black.

Head with scattered moderately large punctures. Thorax rugose-punctate; parapsidal furrows distinct. Abdomen fully as long as head and thorax united, fully twice as long as its greatest width; 1st and 2nd segments striate, the rest finely longitudinally reticulate, 3rd and 4th segments a little the largest. Forewings reaching apex of abdomen; moderately broad; not much infuscated; discal cilia dense, rather fine; venation pale yellow; stigmal vein moderately long, not very oblique, straight; stigmal spot not well defined. Antennæ short and stout; pedicel one-half longer than wide; 1st funicle joint a little shorter and narrower than pedicel; remaining joints much wider than long, the last six forming a stout club.

♂ Forewings practically hyaline. Antennæ black at base, becoming suffused with brown towards apex, scape slightly thickened; pedicel short and stout; 1st funicle joint a little longer than wide; 2-7 distinctly wider than long, 3rd the widest but not much enlarged.

*Hab*: South Australia. Described from one pair in the collections of the Macleay Museum.

*Types*: Macleay Museum. Sydney; Hymenoptera 4D. the above specimens on a tag. ♂ and ♀ antennæ and forewings on a slide.

*SCELIO NIGRICOXA*, *Dodd*.

"(Archiv für Naturgeschichte," Berlin. February, 1914, p. 78.)

♂ Antennæ wholly black; 1st funicle joint one-half longer than wide; 2nd as wide as long; 3rd only slightly dilated, wider than long; 4-7 much wider than long.

One male caught by sweeping in forest. Gordonvale, 28th July, 1914 (A. A. Girault).

*SCELIO OVI* *Girault*. (Proc. Ent. Soc. of Washington, Vol. XV, No. 1, 1913. pp. 4-5).

Taken in company with *australis*, Froggatt, on roadways at Chindera, Tweed River, and Harwood, Clarence River, N.S.W., May, 1914, also from egg beds of *Locusta danica*, Halifax, Herbert River, N.Q., March, 1914; also one male caught on ground, Cloncurry, West Queensland, 16th April, 1914 (A. P. Dodd).

*SCELIO DIEMENENSIS*, *sp nov.*

♀ Length, 3.40 mm.

Black; legs (except the coxæ) golden yellow. the femora slightly dusky; antennæ wholly black.

Head transverse, with scattered moderately small punctures; ocelli wide apart, the lateral ones touching the eye margins. Thorax one-half longer than wide; scutum and scutellum densely confluent punctate, the punctures not of uniform size, some very large, others very small; punctures not setigerous. Parapsidal furrows indicated. Metanotum rugose. Abdomen as long as head and thorax united, no wider than thorax; wholly longitudinally striate, the striae after the 2nd segment not regularly straight; apex of 3rd segment mesad, and a median area on segments 4-5, smooth, except for a very few scattered pin-punctures (dorsal aspect); segments after 5, irregularly rugulose; 3rd segment slightly the longest. Forewings as in *parvicornis* Dodd. Pedicel nearly as long as wide; 1st funicle joint as long and as wide as pedicel; club not distinctly 6-jointed, at least 7-jointed. Occiput somewhat transversely rugose. Lower half of

face striate, the antennal depression smooth. Abdomen ventrad like dorsal but segments after 3 almost wholly smooth, and with a few scattered punctures. Punctures on head denser on upper portion of face.

*Hab*: Tasmania (Hobart). Described from two females received from Mr. W. W. Froggatt and labelled "Hobart; A. M. Lea."

*Type*: In the South Australian Museum, a ♀ on a tag. antennæ and forewings on a slide.

*Cotype*: In the collections of Mr. W. W. Froggatt, Government Entomologist, Sydney, a ♀ on a tag.

SCELIO AUSTRALIS, *Froggatt* (1910, Farmer's Bulletin No. 29, Department of Agriculture, N.S.W.)

Taken on roadsides at Harwood, Clarence River, N.S.W., in company with *ovi* Girault, *pilosiceps* Dodd, and *striatifacies* Dodd, May, 1914 (A. P. Dodd); on roadsides Chindera, Tweed River, N.S.W., May, 1914, in company with *ovi* (A. P. Dodd); on roadway, Childers, South Queensland, 1st July, 1914 (A. P. Dodd); and many hundreds around egg beds of *Locusta danica*, Halifax, Herbert River, N.Q., March, 1914 (A. P. Dodd). On warm, clear days it was noticed that during the middle of the day, the *Scelios* remained inactive. In searching for host eggs, the female, with the antennæ held quivering in front of her head, digs obliquely in the earth with the forelegs, which are kept in constant motion the while.

SCELIO STRIATIFACIES, *sp. nov.*

♀ Length, 4.05 mm.

Very similar to *nigricoxa* Dodd, but somewhat stouter, the abdomen distinctly so; parapsidal furrows very distinct (not or only faintly indicated in *nigricoxa*); metanotum finely rugose (very coarsely so in *nigricoxa*); abdominal segments after the 2nd finely striate, the cross-striæ distinct, the longitudinal ones hence irregular (in *nigricoxa* abdomen strongly striate, the cross-striæ not showing, the longitudinal ones hence without irregularities); face round antennal depression circularly striate, the striæ

converging toward the mouth (in *nigricornis*, face round antennal depression rugose, the striæ only present below insertion of antennæ); antennal depression smooth in both species. Antennæ wholly black; 1st funicle joint distinctly larger than pedicel, one-half longer than greatest width, others very transverse.

*Hab*: New South Wales (Harwood, Clarence River). Described from one female taken in company with *ovi*, *australis* and *pilosiceps*, 26th May, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

*SCELIO PILOSICEPS*, *sp. nov.*

♀ Length, 4.00 mm.

Very similar to *australis* Froggatt but the coxæ are black; the head, pronotum and sides of thorax have the dense long white pubescence of *pilosus* Dodd; the head in *australis* is uniformly rugose, in this species the rugosity is less coarse and the caudal portion of the vertex and the occiput are transversely rugose; the parapsidal furrows are not indicated; the striæ on the abdominal segments are finer, disappearing in extreme meson of the 4th segment, all the segments with short cross-striæ joining the longitudinal ones (these striæ much less distinct in *australis* and not present on segment 4-6), segments 4-5 in *australis* have a median longitudinal carina more or less distinct, this is absent in *pilosiceps*; also the legs are of a deeper color: otherwise the same or nearly so.

*Hab*: New South Wales (Harwood, Clarence River). Described from one female taken with the preceding species.

*Type*: In the South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

*SCELIO AFFINIS*, *sp. nov.*

♂ Length, 3.70 mm.

Very similar to *australis* but differs as follows:— in *australis* the striæ on the 3rd segment are irregular, this being caused by the short cross-striæ, in this species the striæ are uniform without any irregularities; the

antennal depression in *affinis* is rugose immediately above the insertion of the antennæ, the upper part of the depression smooth, in *australis* the upper portion of the depression is finely rugose, below this smooth, also there is a distinct median carina running from vertex of this depression to the elevation on which the antennæ are inserted: the 3rd funicle joint is not so much enlarged, wider than long, no longer than 2nd (distinctly so in *australis*), and distinctly shorter than 1st (as long as 1st in *australis*), also the antennæ are colored differently, the scape being red, next four joints slightly suffused with red, apical five joints black (compared with ♂ *australis*).

*Hab*: North Queensland (Gordonvale, near Cairns). Described from one male caught by sweeping in forest, 26th May, 1914 (A. A. Girault).

*Type*: In the South Australian Museum, a ♂ or a tag, antennæ and forewings on a slide.

SCELIO LOCUSTÆ, *sp. nov.*

♀ Length, 3.10 mm.

Very similar to *pilosiceps*, Dodd, but the femora also black, the pubescence not nearly so distinct, the head more quadrate, the rugosity on the head still finer and not transverse caudad, the rugosity on scutum and scutellum having a distinct tendency to become longitudinal, scutellum with a median longitudinal carina, the meson of 4th abdominal segment not smooth, the pedicel and funicle joints distinctly shorter.

*Hab*: North Queensland (Halifax, Herbert River). Described from one female taken with *ovi*, *australis*, and *perplexus* from egg bed of *Locusta danica*, March, 1914 (A. P. Dodd).

*Type*: South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

SCELIO PERPLEXUS, *sp. nov.*

♂ Length, 3.95 mm.

Very similar to *australis* but the coxæ are black; the funicle joints are more yellowish, the joints after the 1st wider than long, the 3rd not much enlarged; sculpture of abdomen as in *orientalis* Dodd.

*Hab.*: North Queensland (Halifax, Herbert River). Described from one male taken in egg bed of *Locusta danica* in company with *locustæ*, *ovi* and *australis*, March, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

SCELIO FROGGATTI, *Crawford*.

I am not able to reconcile the male specimen identified by Girault (Ent. Soc. of Washington, D.C., Vol. XV, No. 1. 1913, pp. 6-7) and myself (Trans. Royal Soc. of South Australia, Vol. XXXVII. 1913, p. 13") with Crawford's species. Crawford had only female specimens but in Mr. W. W. Froggatt's collection there are males labelled "*Scelio froggatti*," and said to have been bred with the female type material. These males have the antennæ colored as in *australis*. Moreover it does not seem likely that a female with dark brown (*i.e.* black) antennæ should have a male with the antennæ wholly honey yellow. The antennæ of this male specimen differ from those of *ovi* and *australis* in that the third funicle joint is not much enlarged.

SCELIO FULGIDUS, *Crawford*.

Crawford's description gives the color of the abdomen as dark brown, but in the Froggatt collection are specimens of the type material with the abdomen jet black. It is possible that Crawford's specimens had the abdomen discolored in some way, perhaps from remaining long in alcohol. *Fulgidus* has a broader type of abdomen than the species related to *australis*, as have also *pulchellus* (Crawford) and *chortoicetes* Froggatt, of which I have seen specimens.

SCELIO, *sp.* ?

In March, 1914, in company with other *Scelios* on egg-beds of *Locusta danica* Halifax, Herbert River, N.Q., five specimens were observed with a reddish thorax, but unfortunately were not captured.

SCELIO PUNCTATICEPS, *Dodd*.

"Archiv für Naturgeschichte," Berlin, 79. February, 1914, pp. 77-8.

Abdominal segments after the first, finely striate : head densely confluent punctate, except for transverse area (very narrow) between the lateral ocelli, which is practically smooth, stigmal vein not curved. Type re-examined, also one female caught by sweeping in forest, Pentland, 200 miles west of Townsville, September, 1914 (A. A. Girault)

*Genus ENCYRTOSCELIO, new genus*

♀ Vertex of head extraordinarily lengthened, being as long cephalo-caudad as its greatest width, and as long as the thorax, but no wider, its cephalic margin convex, and with a rim or carina following the cephalic margin from eye to eye : eyes moderately large, but not half as long as the head, bare, situated far down on the sides of the face ; ocelli absent ; viewed from the side, the head is conical, the apex of the cone cephalad, and almost pointed. Antennæ inserted in a deep depression, near the mouth, and right against the vertex of the thorax : 12-jointed, with five funicle and five club joints. Mandibles extraordinarily long and slender, straight, several times as long as wide, and nearly as long as the long scape, with three small teeth. Legs normal. Thorax stout, as long as wide, as in *Hadronotus* Förster, the pronotum not visible, the scutum large but wider than long : scutellum semicircular, projecting over and completely hiding the short metanotum. Abdomen broadly sessile, short and stout, as in *Hadronotus*, no wider or longer than the thorax ; 2nd segment the longest, occupying nearly one-half of the surface. Forewings narrowed at base, the caudal margin straight (i.e. when the wing is outstretched the caudal margin runs at right angles to the body), and not at all curved, the cephalic margin much inclined cephalad, so that the wing is nearly hemispherical, the caudal margin forming the base, the distal margin broadly rounded, but cut sharply off at the caudal margin ; the proximo-cephalad margin of the hemisphere prolonged and narrowed towards the caudal

margin at base, the cephalic and distal margins of the wing shaped like a section of a balloon; marginal cilia absent on both the cephalic and caudal margins, the distal margin serrated and with extremely dense, long, curved cilia, quite as long as the greatest wing width, and appearing like plumes; discal cilia apparently absent, or so fine as not to be seen; wings just reaching apex of abdomen, and not much longer than their greatest width; totally without venation.

This genus is utterly unlike any other *Scelionid* genus known. Its thoracic and abdominal characters suggest its relationship with the genus *Hadronotus*, but its extraordinarily shaped head, the absence of ocelli, and the peculiar wings make it unique for the family. It is undoubtedly the most remarkable *Scelionid* genus at present known to science.

*Type*: *ENCYRTOSCELIO MIRISSIMUS* described herewith.

*ENCYRTOSCELIO MIRISSIMUS, sp. nov.*

♀ Length, 1.15 mm.

Coal black; the legs (except the coxæ) and first seven antennal joints golden yellow, the funicle joints a little dusky.

Head and thorax with fine, polygonal, scaly sculpture, the head also with small scattered punctures, the punctures not setigerous. Abdomen with close polygonal reticulation, the reticulation in raised lines. Antennæ 12-jointed; scape long and slender; pedicel one-half longer than wide, fully as long as first two funicle joints combined; funicle joints transverse, the 1st narrower than the others; club 5-jointed, joints 1-4 distinctly wider than long, 2nd slightly the widest. Forewings somewhat infuscated, opaque.

*Hab*: North Queensland (Gordonvale, near Cairns). Described from one ♀ caught by sweeping in forest, 3rd January, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

## Subfamily Telenominæ.

*Genus* PARATELENOMUS. *new genus.*

♀ Agreeing with the description of *Dissolcus* Ashmead but the occiput of the head is distinctly concave, the scutum is distinctly wider than long: the parapsidal furrows are complete, and distinct; and the abdomen is broadly oval, scarcely as long as the head and thorax united, only slightly longer than wide, the 2nd segment much wider than long. Like *Telenomus* Haliday but differing in bearing complete parapsidal furrows.

*Type*: TELENOMUS BICOLOR, *Dodd.*

Ent. News, Philadelphia, U.S.A., Vol XXV. June, 1914, pp. 251-2.

*Genus* PHANUROMYIA. *new genus.*

♀ Like *Telenomus* Haliday but the ovipositor and its valves exerted for a length equal to that of the abdomen.

I have not previously seen, nor have I come across record of, any *Scelionid* with a truly exerted ovipositor, that is with the valves exerted, and thus, I think that character alone all sufficient to form a quite distinct new genus.

*Type*: the following species.

*PHARUNOMYIA RUFOBASALIS. sp. nov.*

♀ Length, 0.95 mm.

Black; legs (including coxæ) and antennal scape golden yellow; pedicel and funicle suffused yellowish: first abdominal segment bright reddish.

Head transverse, no wider than the thorax. dorsal aspect, its cephalic margin convex, the occiput concave; eyes rather large; ocelli wide apart, small, the lateral ones situated against the eye margins. Thorax no longer than wide; scutum large, without furrows; postscutellum faintly emargined at meson; metanotum very short, its caudo-lateral angles sub-acute. Abdomen distinctly narrower than the thorax; one-half longer than wide;

1st segment short, striate; 2nd occupying almost all surface, striate at base, smooth for the rest; the abdomen squarely truncate at apex. Forewings reaching a little beyond apex of wing; moderately broad; hyaline; marginal cilia not long; discal cilia fine and dense; submarginal vein attaining costa somewhat before middle of wing; marginal vein one-half as long as the stigmal, which is not long, rather oblique; postmarginal about twice as long as the stigmal. Antennæ 11-jointed; scape rather short, as long as next three joints combined; pedicel one-half longer than wide; first funicle joint about subequal to pedicel; 2nd quadrate; 3rd and 4th distinctly narrower than preceding, transverse; club 5-jointed, joints 1-4 distinctly wider than long; 1st small, 2nd slightly the largest.

*Hab*: South Queensland (Childers). Described from one female caught by sweeping in forest, 2nd July, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a slide.

*Genus* **TELENOMUS**,<sup>1</sup> *Haliday*.

**TELENOMUS** **ŒCLEOIDES**, *sp. nov.*

♀ Length, 1.15 mm.

Very similar to *œcleus* Dodd but smaller; pedicel not twice as long as wide, the first funicle joint a little shorter and narrower than pedicel, the 2nd wider than long; the club joints shorter, all distinctly wider than long. Compared with *œcleus*.

*Hab*: North Queensland (Halifax, Herbert River). Described from one female caught by sweeping miscellaneous vegetation, 20th March, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

**TELENOMUS** **OBLITERATUS**, *sp. nov.*

♀ Length, 1.20 mm.

Like *œcleus* but smaller; femora also black; striæ on 2nd abdominal segment so feeble as to be hardly discernible; only first five antennal joints yellow, the pedicel

only one-half longer than wide, first funicle joint as long and as wide as pedicel, the 2nd a little longer than wide, club joints all distinctly wider than long; abdomen shaped as in *æcleus* but the 2nd segment shorter, the following more than half its length.

*Hab* · North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in jungle, 26th March, 1914 (A. A. Girault).

*Type* · In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

*TELENOMUS EUANDER*, *Dodd*.

One female sweeping in forest, Burnett Heads, Bundaberg, S.Q., 20th June, 1914 (A. P. Dodd); also several females sweeping in forest, Pentland, 200 miles west of Townsville, N.Q., September, 1914 (A. A. Girault).

*TELENOMUS DIEMENENSIS*, *sp. nov.*

♀ Length, 1.70 mm.

Coal black: the tibiæ and tarsi reddish yellow.

Head very transverse, wider than the thorax; ocelli large, the lateral ones touching the eye margins. Thorax a little longer than wide. Abdomen a little longer and wider than the thorax, the second segment occupying nearly two-thirds of surface. Head, scutum and scutellum finely rugulose and pubescent; 1st and basal two-thirds of 2nd abdominal segment, striate, the rest smooth, the remaining segments with setigerous pin-punctures. Forewings long and broad; infuscated, this deepest around knob of stigmal vein; base of wing, and caudal and disto-caudal margins almost hyaline; discal cilia fine, very dense; venation fuscous; submarginal vein attaining the costa about middle of wing; marginal vein one-fourth as long as the stigmal, which is very long, oblique, with a distinct knob, postmarginal twice as long as the stigmal. Scape long; pedicel nearly twice as long as greatest width; first funicle joint very long, nearly twice as long as pedicel, over one-half as long as the scape, and as long as three following joints united; 2nd a little longer than wide; 3rd quadrate club 6-jointed, joints 1-5 distinctly wider than long, 2nd the longest and widest.

*Hab*: Tasmania (Hobart). Described from three females received from Mr. W. W. Froggatt, and labelled "Hobart, A. M. Lea."

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

*Cotypes*: In the collection of Mr. W. W. Froggatt, Government Entomologist, Sydney, two ♀s on a tag.

*TELENOMUS ÆGEUS, sp. nov.*

♀ Length, 1.00 mm.

Shining black; legs (except cephalic coxæ) golden yellow also the antennal scape, the next six antennal joints yellow suffused dusky.

Head viewed from above, not twice as wide as long, the vertex and frons a little convex, a little wider than the thorax; with fine polygonal scaly sculpture. Thorax scarcely longer than wide, the scutum with the same scaly sculpture and also with fine setigerous pin-punctures, the scutellum practically smooth and glabrous. Abdomen as long as the head and thorax united; as wide as the thorax: twice as long as wide; almost pointed at apex; 1st segment short, striate, the 2nd occupying one-half of surface, faintly striate at base, then with fine, scaly sculpture. its apical margin smooth; remaining segments with fine pin-punctures. Scape as long as next four joints combined: pedicel one-half longer than wide; funicle joints a little narrower than pedicel, first one-half longer than wide; 2nd barely longer than wide; 3rd quadrate; 4th transverse; club 5-jointed, first joint very small, the 2nd abruptly larger, 1-4 transverse, the 3rd slightly the largest. Forewings reaching apex of abdomen; not very broad; hyaline: discal cilia fine and dense; submarginal vein attaining costa about middle of wing; marginal vein one-third as long as the stigmal, which is moderately long and oblique: postmarginal over twice the length of the stigmal; venation indistinct.

*Hab*: North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in jungle, 30th July, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a slide.

*TELENOMUS AJAX*, *sp. nov.*

♀ Length, 0.90 mm.

Similar to *ægeus* but the head, viewed from above, is distinctly more than twice as wide as long, the vertex and frons not convex; the thorax distinctly wider than the abdomen; the 2nd segment with the polygonal sculpture not so distinct, the segment almost wholly finely striate, and occupying over two-thirds of the surface, the remaining segments smooth, without punctures; antennæ more yellow, the 2nd club joint brownish, the first funicle joint scarcely longer than wide, the second wider than long.

*Hab*: North Queensland (Gordonvale, near Cairns). Described from one female captured with the preceding species.

*Type*: In the South Australian Museum. a ♀ on a slide.

## Subfamily Bæinæ.

Genus *CERATOBÆOIDES*, *Dodd*.

The type and second species of this genus, have been re-examined finding the following additional generic characters:—Postscutellum with a long, erect spine: head viewed from in front, triangular, distinctly longer (dorso-ventrad) than greatest width.

*CERATOBÆOIDES SPINOSUS*, *sp. nov.*

♀ Length, 1.60 mm.

Golden yellow; eyes, ocelli, a square patch against cephalic margin of scutum mesad and adjacent border of occiput, and horn on basal abdominal segment, black: apical club joints dusky black.

Head viewed from above, transverse, somewhat wider than the thorax; the latter as wide as long; head and thorax finely densely reticulate and pubescent. *Parapsidal furrows present on posterior half of scutum*. Abdomen somewhat longer than head and thorax united; 1st segment as wide as long, with a blunt horn; 3rd a little longer than 2nd, the remaining segments very short; 1st and 2nd segments striate, the 3rd finely densely granulate. Fore-

wings long and broad; almost hyaline, with a dark spot round the marginal vein; discal cilia moderately fine, very dense; marginal vein barely one-half as long as the stigmal, which is long, rather oblique, straight; venation yellowish. Scape long and slender; pedicel over twice as long as wide, funicle joints narrower than the pedicel, 1st almost twice as long as wide, 2-4 somewhat wider than long; club slender, over twice as long as wide, 4-jointed, divided obliquely.

*Hab*: South Queensland (Childers). Described from one female caught by sweeping in forest, 2nd July, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

*Genus CERATOBÆUS, Ashmead.*

*CERATOBÆUS FLAVIVENTRIS, sp. nov.*

♀ Length, 1.15 mm.

Head, thorax and horn on abdomen, black; abdomen, legs, and antennæ, bright golden yellow.

Antennæ 7-jointed; scape as long as next four joints combined; pedicel over twice as long as wide; funicle joints narrower than the pedicel, 1st twice as long as wide, 2-4 wider than long; club as long as the scape. Forewings almost reaching apex of abdomen; hyaline; moderately broad; venation very pale, indistinct; marginal vein one-half as long as the stigmal, which is rather long, almost perpendicular; basal vein perpendicular, indistinct. Head transverse, a little wider than the thorax, the latter quadrate, both finely densely granulate. Abdomen distinctly longer than the head and thorax combined; somewhat narrower than the thorax; pointed at apex; first two segments striate, the remaining segments finely polygonally scaly; horn on basal segment reaching apex of scutellum; 3rd segment occupying over one-third of surface, as long as wide.

*Hab*: North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in forest, 14th August, 1914 (A. A. Girault).

*Type*: In the South Australian Museum, a ♀ on a slide.

*Genus ACOLUS, Færster.**ACOLUS BIDENTATUS, sp. nov.*

♀ Length, 1.75 mm.

Black; abdomen dark brown. coxæ black: rest of legs and the antennæ golden yellow, slightly suffused dusky.

Head, viewed from above, transverse, distinctly wider than the thorax: the frons convex, viewed from in front, much wider than long, eyes large, pubescent: ocelli very wide apart, the lateral ones touching the eye margins. Thorax somewhat longer than wide, the scutum and scutellum large; posterior angles of the metanotum, acute; postscutellum with two short teeth mesad. Abdomen as long as the head and thorax united, no wider than the head: broadly rounded behind, 1st and 2nd segments striate, the 3rd and 4th finely, densely, irregularly transversely rugulose; the 3rd occupying one-half of surface. Head, scutum and scutellum, finely densely punctate. Forewings just reaching apex of abdomen: moderately broad; hyaline; discal cilia fine, very dense: venation dark and distinct; submarginal vein attaining the costa at fully one-half wing length: marginal vein not one-third as long as the stigmal, which is moderately long, wholly gently convexly curved, the convexity *proximal*: basal vein not indicated. Antennæ 7-jointed: scape long and slender: pedicel one-half longer than wide: funicle joints narrower than the pedicel, 1st a little longer than wide, 2-4 very transverse; club large, one-half longer than wide.

*Hab*: North Queensland (Pentland, 200 miles west of Townsville). Described from one female caught by sweeping in forest, 8th January, 1913 (A. A. Girault).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

## Subfamily Teleasinae.

*Genus HOPLOGRYON, Ashmead.**HOPLOGRYON NIGRIVENTRIS, sp. nov.*

♂ Length, 1.90 mm.

Black: scutum (except a large square patch mesad and cephalad, reaching almost to posterior margin), post-

scutellum, and extreme sides of scutellum, bright red-brown; antennal scape, pedicel and the legs, golden yellow, the coxæ, apex of femora, apical third of the tibia, and the tarsi, dusky.

Head transverse, no wider than the thorax. ocelli close together, in an equilateral triangle; face striate, the striæ converging towards the mouth; the vertex also longitudinally striate. Thorax somewhat longer than wide; scutum and scutellum reticulately rugulose; spine on postscutellum, large, blunt; caudo-lateral angles of metanotum acute. Abdomen about as long as the head and thorax united; 1st segment longer than wide; 1st and 2nd segments striate, the 3rd (except laterad and distad) finely longitudinally rugulose; rest of abdomen smooth, except for scattered pin-punctures, these dense at cephalic margin of segments 4-6 where the surface is also finely granulate; venter of 1st and 2nd segments striate, remaining segments with scattered setigerous pin punctures. Forewings reaching beyond apex of abdomen; broad, the apex truncately rounded; infuscated; discal cilia rather coarse, very dense; marginal vein much shorter than the submarginal; the stigmal vein long for the genus and with a distinct knob, a fourth as long as the marginal; basal vein indicated; venation fuscous. Antennæ not much longer than the body; 1st funicle joint longest of funicle, slightly longer than 2nd, the latter slightly longer than 3rd; 3-9 subequal, the 10th as long as 1st; pedicel very short.

*Hab*: New South Wales (Upper Tweed River). Described from one male caught by sweeping foliage of jungle plants, 1,000 feet, 17th May, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

*Genus* PENTACANTHA, *Ashmead*.

PENTACANTHA NIGRINOTUM, *sp. nov.*

♀ Length, 1.45 mm.

Black; thorax (except scutum and scutellum), and first abdominal segment (except its horn) reddish brown; legs (including the coxæ) golden yellow; antennæ wholly black.

Head transverse, a little wider than the thorax. Thorax somewhat longer than wide. Head, scutum and scutellum pubescent, and with raised reticulation. Spines on post-scutellum and metanotum, short. Abdomen no longer than the head and thorax united; no wider than the thorax. 1st segment as long as wide, with a blunt distinct horn; 3rd segment occupying nearly one-half of surface; 1st and most of 2nd segments striate, the rest smooth. Forewings reaching apex of abdomen; moderately broad; somewhat infuscated, discal cilia fine, very dense; venation fuscous, the stigmal vein almost perpendicular and with a slight knob. Pedicel one-half longer than wide, subequal to 2nd funicle joint, the 1st a little longer. 3rd and 4th very transverse; club 6-jointed, joints 1-5 of almost equal length, 2nd slightly the widest.

*Hab.* North Queensland (Halifax, Herbert River). Described from one female caught on foliage of plants around canefields, 30th March, 1914 (A. P. Dodd).

*Type.* In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

*Genus* TRIMORUS, *Førster*.

TRIMORUS NIGRELLUS, *Dodd*.

Two males taken from foliage of custard-apple in garden, Townsville, N.Q., 21st April, 1914 (A. P. Dodd).

Family DRYINIDÆ.

Subfamily Dryininae

*Genus* NEODRYINUS, *Perkins*.

NEODRYINUS TRILINEATUS, *sp. nov.*

♀ Length, about 5 mm.

Black: anterior coxæ (more or less), anterior trochanters, all tarsi (except claw joint on two hind pair of legs), basal third of posterior tibiæ, mandibles, and antennæ, clear golden yellow: anterior tibiæ brown; head, reddish-brown, the eyes, ocelli, and a large area occupying centre of face, black.

Vertex of head, scutum, scutellum, and postscutellum very finely granulate-rugose, and with silvery white pubescence; face finely longitudinally rugulose-striate; pronotum very finely, subconcentrically rugulose. Parapsidal furrows very feebly indicated. Metanotum with raised irregularly longitudinal reticulation and finely densely granulate. Abdomen minutely microscopically sculptured, not shining. Forewings with *three* smoky bands, base of wing hyaline; the 1st band much wider than the 2nd which is quite narrow and covers apex of basal cells; 3rd band much broader than the others, commencing at half length of stigma, its distal margin somewhat convex; apex of wing hyaline. Antennæ slender, the flagellum gently incrassate, the 1st funicle joint very long, almost as long as three following joints united.

*Hab*: New South Wales (Chindera, Tweed River). Described from one female caught by sweeping foliage and grass in a swamp, 14th May, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag. This species will be easily distinguished from the three other Australian species, *koebelei* Perkins, *nelsoni* Perkins, and *raptor*. Perkins, by the trifasciate wing.

#### Subfamily Anteoninae.

#### Genus ANTEON, *Jurine*.

#### ANTEON PARVULUS, *Perkins*.

One female sweeping in forest on hills, Maclean, Clarence River, New South Wales, 27th May, 1914 (A. P. Dodd).

#### Family PLATYGASTERIDÆ.

#### Genus PLATYGASTOIDES, *Dodd*.

#### PLATYGASTOIDES NITIDUS, *sp. nov.*

♀ Length, 2.65 mm.

Black; the legs concolorous, except proximal third of the tibiæ, and tarsi, which are ferruginous, also the antennal pedicel and first funicle joint.

Vertex of head rather thin, the frons twice as wide as long (cephalic view), the eyes and ocelli large, the latter rather close together. Head with fine polygonal scaly sculpture and scattered circular punctures, the latter more dense toward the mouth. Antennæ 10-jointed; scape with an enormous leaf like expansion; pedicel normal, nearly twice as long as wide; 1st funicle joint very short, transverse; 2nd much wider than first and over twice as long as greatest width; 3rd and 4th as long as greatest width, 2-4 dilated at middle; club 4-jointed, joints 1-3 distinctly longer than wide, last as long as previous two united. Forewings very long, reaching well beyond apex of abdomen; broad; darkly infuscated; discal cilia rather sparse; submarginal vein present. Scutum and scutellum with very fine scaly sculpture; parapsidal furrows deep, widening caudad and forming a deep sulcus; near lateral margin, a deep groove runs half way from caudal margin cephalad; scutellum transverse, with a median carina, and with a deep sulcus running from centre caudad diagonally to cephalo-laterad angles, the area caudad of this smooth. Abdomen rather flattened; as long as the head and thorax united, fully twice as long as wide; 2nd segment occupying nearly one-half of surface; striate laterad, the first three segments otherwise smooth, the rest smooth mesad, then finely rather densely, punctate.

*Hab*: South Queensland (Childers). Described from one female caught by sweeping in strip of jungle, 27th June, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the head and forewings on a slide.

PLATYGASTOIDES NITENS. *sp. nov.*

♀ Length, 2.35 mm.

Very similar to the foregoing but the first funicle joint though small is longer than wide; the first three club joints are wider than long (the last is missing); the parapsidal furrows, though widening caudad, do not form the wide sulcus as in *nitidus*; and the median carina of the scutellum is obscure (distinct in *nitidus*)., tibiæ almost wholly

black. Metanotum in both species with a distinct median carina; also at cephalic ends of parapsidal furrows is a circular fovea.

*Hab*: New South Wales (Tweed Heads, Tweed River). Described from one female caught by sweeping in jungle. 4th May, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

### Family CERAPHRONIDÆ.

#### *Genus DENDROCERUS, Ratzburg.*

*DENDROCERUS VARIEGATUS, sp. nov.*

♀ Length, 3.25 mm.

Varnished brown, legs (including coxæ), and first three antennal joints, golden yellow, rest of antennæ brown.

Vertex of head rather flattened; eyes very large; ocelli large, the lateral pair almost touching the eye margins and each other; a row of small foveæ runs from cephalic ocellus to posterior margin of the vertex. Thorax over one-half longer than wide; finely scaly, and with scattered punctures; median groove of scutum deep and distinct; scutellum longer than wide. Abdomen slightly longer than head and thorax united. Forewings long; moderately broad: almost hyaline, with a dark blotch beneath all of stigma and stigmal vein, continued nearly to caudal margin; discal cilia moderately fine, dense; stigma twice as long as wide, stigmal vein twice as long as the stigma; venation clear honey yellow. Antennæ slender: slightly widening toward the apex, scape slender: pedicel thrice as long as wide; first funicle joint one-fourth longer than pedicel; second a little shorter than pedicel; 4-8 all distinctly longer than wide; last joint as long as the pedicel.

*Hab*: New South Wales. Described from one female in the collection of the Macleay Museum.

*Type*: Macleay Museum, Sydney; Hymenoptera, 7D, a ♀ on a tag, the antennæ and forewings on a slide.

*DENDROCERUS VARIIPES, sp. nov.*

♀ Length, 1.10 mm.

Dark dull brown, the head and scutum lighter: eyes and ocelli, black; legs (including the coxæ), pale silvery yellow, the posterior femora, and apical third of posterior tibiæ black; pedicel and first three funicle joints silvery white, contrasting with the fuscous remaining antennal joints.

Head somewhat wider than the thorax: transverse. Thorax over one-half longer than wide: densely finely granulate, except the metanotum, which is smooth and shining; scutum with a median groove not very distinct; scutellum longer than wide, convex. Abdomen conic-ovate: pointed at apex; no longer or wider than the thorax; convex above and beneath, almost as high as long. Forewings reaching apex of abdomen: moderately broad base and apex hyaline, the rest deeply clouded, discal cilia fine, very dense; stigma semicircular, the stigmal vein scarcely longer and almost straight. Antennæ slightly widest in centre, the joints all longer than wide; pedicel one half longer than wide, a little shorter than first funicle joint which is a little longer than the second or third, the fourth slightly the longest.

*Hab*: New South Wales (Upper Tweed River). Described from one female caught by sweeping in open forest, 1,000 feet, 17th May, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

*Genus MEGASPILUS, Westwood.**MEGASPILUS CONSPICUUS, sp. nov.*

♀ Length, 2.10 mm.

Black; legs (including coxæ), and antennal scape, pedicel, and first funicle joint more or less, bright golden yellow.

Head and thorax with circular punctures, not large or confluent, the punctures absent on a mesal path of scutellum, this path quite smooth, the propodeum rugulose. All punctures setigerous. Thorax longer than wide;

median and parapsidal furrows of scutum, distinct; scutellum longer than wide; postscutellum produced into a triangular blunt spine; posterior angles of the metanotum, acute. Abdomen as long as the head and thorax united; first segment occupying two-thirds of surface, striate for its basal third, smooth for the rest; the remaining segments pubescent. Forewings reaching apex of abdomen; broad, somewhat infusate; stigma semicircular; stigmal vein scarcely curved, twice as long as the stigma; venation fuscous. Scape long and slender; pedicel almost twice as long as wide; first funicle joint a little longer than pedicel; second shorter; the remainder slightly and gradually widening; 4-8 a little wider than long.

*Hab*: South Queensland (Burnett Heads, Bundaberg). Described from two females caught by sweeping in forest, 20th June, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

*MEGASPILUS PUNCTATIVENTRIS, sp. nov.*

♀ Length, 1.90 mm.

Coal black; legs and antennal scape, golden yellow, the coxæ black.

Head not very transverse; lenticular, the frons and vertex gently convex, finely rugulose; eyes very large, pubescent. Thorax one-half longer than wide; scutum and scutellum with rather coarse, dense scaly sculpture and whitish pubescence; median and parapsidal furrows of scutum distinct; scutellum longer than wide, postscutellum with a short, stout spine. Abdomen no longer or wider than the thorax; pointed at apex; convex beneath, straight above, the apex somewhat upturned; second segment occupying over two thirds of surface, striate at its base, then with dense longitudinal rows of rather small oval punctures. Forewings reaching apex of abdomen; broad, the apex squarely rounded; hyaline; discal cilia moderately coarse, rather dense, venation pale fuscous, the stigma pale yellow; stigma semicircular, the stigmal vein no longer than the stigma. Antennæ 11-jointed; scape longer than next four joints combined; pedicel

over twice as long as wide ; first funicle joint as long as the pedicel ; 2nd and 3rd wider than long . 4th the widest of the funicle, rather abruptly larger than the preceding, a little longer than wide ; the others slightly decreasing in width, all a little longer than wide. Femora (especially the posterior pair) distinctly swollen.

*Hab* : New South Wales (Chindera, Tweed River). Described from one female caught by sweeping foliage of mangrove and other bushes, 14th May, 1914 (A. P. Dodd).

*Type* : In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

A species close to *australicus* Dodd.

*MEGASPILUS FLAVICINCTUS*, *sp. nov.*

♀ Length, 2.10 mm. Of stout form.

Golden brown : the eyes, ocelli, metanotum, and all centre of abdomen, black : legs golden yellow, also the first two antennal joints, the third brownish, the remainder black.

Head transverse, no wider than the thorax, with dense thimble punctures, these with rather long whitish pubescence ; eyes not large, pubescent. Thorax barely longer than wide, the scutum and scutellum with rather dense, thimble punctures and long whitish pubescence, scutellum no longer than wide : median and parapsidal furrows of scutum deep and distinct, postscutellum with a stout spine : projecting a little over the abdomen ; metanotum very short at meson. Abdomen a little longer than the head and thorax united, a little wider than the thorax : second segment occupying over one-half of surface, striate at its base, the rest smooth. Forewings reaching a little short of apex of abdomen : broad, the apex rather squarely rounded : somewhat infuscate, this deepest beneath stigma and stigmal vein ; discal cilia moderately coarse and dense : venation fuscous ; stigma semi-circular ; stigmal vein scarcely curved, over twice as long as the stigma. Antennæ 11-jointed ; scape as long as next five joints combined ; pedicel stout, a little longer than

wide; first funicle joint as wide as pedicel and longer, almost twice as long as wide; 2-8 transverse, distinctly increasing in width, last joint over twice as long as wide, longer than two preceding joints united.

*Hab*: Tasmania (Hobart). Described from one female received from Mr. W. W. Froggatt and labelled "Hobart, A. M. Lea."

*Type*. In the collections of Mr. W. W. Froggatt, Government Entomologist of New South Wales, a ♀ on a tag, the antennæ and forewings on a slide.

*Genus* CONOSTIGMUS, *Dahlbom*.

CONOSTIGMUS FLAVIBASALIS, *Dodd*.

Head and thorax black, abdomen sometimes almost wholly pale, with the caudal half dorsad, dusky. Head densely finely punctate and pubescent, the thorax with scattered pubescence and pin-punctures. Abdomen stout, distinctly convex above and below.

Several females sweeping miscellaneous vegetation, chiefly jungle, Grafton, Clarence River, New South Wales, 3rd June, 1914 (A. P. Dodd).

CONOSTIGMUS RUFINOTUM, *Dodd*.

Head, scutum and scutellum, smooth and shining except for indefinite punctuation. Eyes occupying whole side of face, pubescent. First funicle joint distinctly shorter and narrower than pedicel.

Two females sweeping forest, sand ridges near coast, Chindera, Tweed River, New South Wales, 13th May, 1914 (A. P. Dodd).

CONOSTIGMUS CONCOLORIPES, *sp. nov.*

♀ Length, 1.80 mm.

Coal black; the legs and basal antennal joints, fuscous; tarsi yellowish.

Head transverse; somewhat wider than the thorax; densely polygonally scaly; eyes large, pubescent. Thorax one-half longer than wide; scutum and scutellum with

rather coarse dense scaly sculpture; scutellum longer than wide; parapsidal and median furrows of scutum distinct; metanotum rather long, more or less finely reticulately rugulose, with several irregularly longitudinal carinae. Abdomen rather slender, no longer than the head and thorax united. Head densely pubescent, the thorax with only scattered pubescence. Forewings rather long; broad, the apex squarely rounded; infusate, this deepest beneath stigma and stigmal veins; discal cilia rather fine and dense; venation fuscous; stigma semicircular; stigmal vein scarcely curved, twice as long as the stigma. Antennae slender, only very slightly increasing in width toward apex; pedicel over twice as long as greatest width; first funicle joint somewhat longer; 2nd two-thirds as long as preceding; 3-8 subequal, all slightly shorter than 2nd, twice as long as wide, the last joint longer.

*Hab*: Tasmania (Hobart). Described from one female received from Mr. W. W. Froggatt and labelled "Hobart, A. M. Lea."

*Type*: In the collections of Mr. W. W. Froggatt, Government Entomologist of New South Wales, a ♀ on a tag, the antennae and forewings on a slide.

*CONOSTIGMUS VARICOLOR, sp. nov.*

♂ Length, 2.45 mm. Of stout form.

Black; lateral lobes of scutum and cephalic margin of median lobe, sides of metanotum and its apex, base of abdomen, and the head, reddish brown; legs and antennal scape golden yellow, the intermediate coxae and base of posterior pair, black; upper third of face black.

Head granulate, and with rather dense setigerous thimble punctures; lower half of face finely transversely rugulose; transverse, a little wider than the thorax. Scutum, scutellum and axillae, granulate, and with numerous scattered thimble punctures, these only present on extreme laterad of the scutellum. Parapsidal and median furrows of scutum deep and distinct. Thorax one-half longer than wide; scutellum as wide as long; metanotum finely longitudinally rugulose. Abdomen no longer or wider than the thorax; convex beneath, almost straight above;

second segment occupying a little more than half of surface, striate at its base, then shining and with fine scaly sculpture, and a few scattered pin-punctures. Anterior and posterior femora much swollen. Forewings reaching apex of abdomen; very broad, truncately rounded at apex; with a large dark area beneath stigmal, stigma, and apex of submarginal veins, and occupying almost all centre of wing; base, apex, and margins nearly hyaline; discal cilia fine, very dense; stigmal vein scarcely curved, nearly twice as long as the semicircular stigma; venation fuscous, scape swollen; pedicel short; funicle joints long and cylindrical, the first longest, nearly thrice as long as its width at apex.

*Hab*: New South Wales (Upper Tweed River). Described from one male caught by sweeping in open forest, 1,000 feet. 17th May, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♂ on a tag, the antennae and forewings on a slide.

CONOSTIGMUS UNICOLOR, *sp. nov.*

♀ Length, 2.05 mm.

Black; tibiae (except posterior pair), and all tarsi, golden yellow; femora and posterior tibiae, fuscous; antennae scape suffused red.

Head, viewed from above, much wider than long, the vertex not thin; densely scaly, this not very fine; eyes occupying whole side of head, pubescent. Thorax one-half longer than wide; scutum and scutellum with scattered pubescence, and polygonal scaly sculpture, this latter very fine except around margins of scutellum where it is distinctly coarse; scutellum longer than wide; metanotum very short; median and parapsidal furrows of scutum, deep and distinct. Abdomen pointed conic-ovate; no longer than the head and thorax united, no wider than the thorax; straight above, convex beneath; second segment occupying barely half of surface, with several strong and numerous fine striae at its base; the abdomen otherwise smooth, except for scattered pubescence on apical segments. Forewings reaching apex of abdomen; broad; lightly infusate, this deepest beneath marginal and stigmal

veins : discal cilia fine and dense ; stigma semicircular ; stigmal vein about twice length of stigma. Antennæ not much increasing in width toward apex, the joints all distinctly longer than wide ; first funicle joint as long as pedicel, about thrice as long as greatest width.

*Hab* : North Queensland (Pentland, 200 miles west of Townsville). Described from two females caught by sweeping in forest. September, 1914 (A. A. Girault).

*Type* : In the Queensland Museum, a ♀ on a tag, antennæ and forewing on a slide.

*Genus* LYGOCERUS, *Færster*.

LYGOCERUS ATERRIMUS. *sp. nov.*

♀ Length, 1.75 mm.

Coal black, the antennæ and coxæ concolorous ; femora and tibiæ fuscous, the tarsi yellow.

Head transverse, slightly wider than the thorax : eyes large. Thorax somewhat longer than wide, almost squarely truncate anteriorly ; median and parapsidal furrows of scutum, distinct ; scutellum longer than wide ; head, scutum, and scutellum with dense scaly sculpture. Abdomen as long as the head and thorax united ; no wider than the thorax ; almost straight above, convex beneath, its apex upturned ; smooth, except for striæ at its base, the second segment occupying slightly over one-half of surface. Forewings reaching apex of abdomen ; broad ; somewhat infusate, this deepest beneath stigma and stigmal vein ; discal cilia dense, rather fine ; stigma semicircular ; stigmal vein almost twice as long as stigma ; venation fuscous. Antennæ 11-jointed : *filiform, not at all widening* ; scape somewhat thickened, as long as next three joints combined ; pedicel two and a-half times long as wide ; first funicle joint subequal to the pedicel ; remaining joints shorter, all longer than wide : the last joint as long as the pedicel.

*Hab* : New South Wales (Maclean, Clarence River). Described from one female caught by sweeping forest on hills, 30th May, 1914 (A. P. Dodd).

*Type* : In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

LYGOCERUS ORNATUS, *sp. nov.*

♂ Length, 1.70 mm.

Coal black; legs (except the black coxæ) fuscous, the knees and tarsi yellow, the antennæ, scape and pedicel suffused red.

Head lenticular; viewed from above, transverse, somewhat wider than the thorax; eyes large, pubescent. Thorax one-half longer than wide; parapsidal and median furrows of scutum distinct; scutellum longer than wide. Head, scutum, and scutellum with rather coarse, dense scaly sculpture and rather sparse pubescence. Abdomen somewhat shorter and narrower than the thorax; convex beneath, straight above, its apex distinctly upturned; second segment occupying nearly three-fourths of surface, striate at its base, then smooth, the apical third with rather dense, fine punctures; remaining segments with scattered fine punctures and pubescence. Forewings attaining apex of abdomen, very broad; hyaline; discal cilia not very fine, rather dense; stigma large, the stigmal vein only slightly longer; venation fuscous, the stigmal vein pale. Antennæ ramose, the first five funicle joints each bearing a very long slender branch, that on the third slightly the longest; scape rather stout; pedicel stout; first funicle joint a little longer than pedicel, a little longer than wide; 2-6 lengthening, the 5th over twice length of 1st, the 6th one half longer than 5th; 7th slightly more than half length of 6th.

*Hab*: North Queensland (Harvey's Creek, near Cairns) Described from one male caught on foliage of plants in jungle country, 12th October, 1914 (A. P. Dodd).

*Type*: In the South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

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# GEOLOGY AND PETROLOGY OF THE ENOGGERA GRANITE AND THE ALLIED INTRUSIVES.

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## PART I.—GENERAL GEOLOGY.

(PLATES XI.-XII.)

(*Read before the Royal Society of Queensland, November 30th,  
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### i.—INTRODUCTORY.

THE following paper aims at a general description of the so-called "Enoggera Granite" and the intrusive rocks lying to the immediate west of the city of Brisbane. The relation of these to the other rocks of the area is pointed out, and a suggestion made as to the probable age of the igneous injections; while the phenomena accompanying such injections are discussed, and the nature of the controlling forces indicated.

Further, the writer endeavours to correlate the granites and other igneous rocks under consideration with those of the New England district of New South Wales, and the Stanthorpe district of Queensland, by means of frequent comparisons. Unfortunately, here the important work of correlation must end since the granites of Queensland— with the sole exception of those of the Stanthorpe area — have received only very meagre attention at the hands of geologists.

In addition to the above, a short description of the physiographical and topographical features of the area is given, and their relation to the igneous rocks demonstrated. This phase of the work is illustrated by a sketch map, showing the chief elements in the topography of the district.

## ii.—GENERAL AND HISTORICAL.

The rocks to be described occur principally in the parishes of Enoggera and Indooroopilly. The area lies to the west of Brisbane, between Kedron Brook on the north, and a line from the mouth of Moggill Creek to Corinda railway station on the south, while to the west it is bounded by Moggill Creek, the Enoggera Reservoir and Cedar Creek.

The earliest reference to the geology of this area which the writer has been able to discover was in the year 1887, when in his "Report to Accompany a Geological Map of the City of Brisbane and its Environs"<sup>1</sup>, Mr. W. H. Rands referred to a "boss" of granite intruded into the schists to the west of Brisbane. "It is," he continued, "but a small patch about three miles in diameter, extending west as far as the Enoggera Reservoir." In his map, Mr. Rands shows a portion of the main outcrop of the Enoggera granite, and also several dykes crossing the track along Taylor Range. In 1897 Mr. R. L. Jack, at that time Government Geologist, reported having passed over granite "from the middle of section 166 to the western boundary of 682 (Enoggera)"<sup>2</sup> when on a visit to the Enoggera Goldfield. Two years

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1. Qld. Geol. Survey, Pub. 34.

2. Annual Progress Report Qld. Geol. Survey, 1897.

later—in 1899—the Geological Survey of Queensland published a map of the “Ipswich Beds, showing their junction with the Gympie Beds along the Brisbane River.”<sup>1</sup> This map accompanied a report on the Ipswich Coal Field by Walter E. Cameron, B.A., and included in its scope the area under discussion.

### iii.—PHYSIOGRAPHY.

The chief physiographical and topographical features of the area are shown in the accompanying sketch-map (Plate XII.). The dominating elements are two ranges of hills roughly about seven hundred feet in height which rise abruptly out of the surrounding foot-hills. These are known as Taylor Range and Enoggera Range.

Taylor Range, starting from Mt. Cootha (746ft.), runs in a direction N. 60° W., through Mt. Constitution (844ft.)—the highest point of the range—towards the Enoggera Reservoir. At Mirror Point, in the north-western corner of Mt. Cootha Reserve, it bifurcates, one branch swinging round to the north-east towards the Enoggera Range, from which it is separated by a very marked depression—known locally as The Gap—through which flows Enoggera Creek. The other arm, which is a considerably more important divide, sweeps round to the south of the Enoggera Reservoir until it runs almost due east and west, when it becomes a spur of the D’Aguilar Range. It thus forms the divide between the waters of Moggill Creek on the south and those of Enoggera Creek on the north.

The Enoggera Range, which lies to the north of Taylor Range, forms an open curve concave to the east, with its highest point Mt. Enoggera (1,000ft.) near the middle of the curve. This range, too, is connected to the D’Aguilar Range by a long ridge, which, in this case, has a west-north-west direction, and passes to the north of the Enoggera Reservoir, thus forming the divide between Cedar Creek (which is a tributary of Kedron Brook) and Enoggera Creek. This latter creek flows then between two almost parallel spurs, and it is just above the point where these begin to

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1. W. E. Cameron, Qld. Geol. Survey, Pub. 147.

diverge that the Enoggera Reservoir is constructed. From both Taylor Range and Enoggera Range spurs are sent out to the east, north-east, and south-east, but these soon merge into rounded and semi-isolated hills. Further away to the east, north and south these in their turn gradually fade into gently-undulating country. This topographical sequence from steep ridges to rounded spurs and foot-hills, to undulating plain can easily be interpreted in terms of the varying resistance to erosion of the different rock formations met with. The granites, and the schists where they have been reinforced by intrusions, weather into steep ridges which, though occasionally precipitous, generally present rather rounded profiles. This description applies equally well to both these rock types since their modes of weathering are so similar that, from a consideration of topography alone, it would be well nigh impossible to tell, when looking from a distance on, say, Taylor Range, where the granite ended and the schist began.

The schists, on the other hand, which have not been strengthened by intrusions are shaped by erosion into semi-detached rounded hills.

The undulating plains which—though they do not occur within the area mapped—succeed these hills of schists, are the result of weathering of the Trias-Jura sediments. The Tertiary gravels where met with form sub-horizontal outcrops, while the recent alluviums are found as typical river flood-plains.

These different modes of weathering are reflected in the courses of such streams as Cubberla Creek, which, rising in a miniature gorge in the heart of the Taylor Range, flows rapidly through its narrow channels into the foot-hills, among which it winds its way in a more leisurely manner, coming at last to the recent alluvium, through which it wanders in typical meandrine fashion before it finally flows sluggishly into the Brisbane River. Another, and perhaps better, example is instanced in Ithaca Creek.

The question has been raised as to whether the Taylor and Enoggera Ranges are to be explained as residuals, or as the result of faulting. Cameron<sup>1</sup> has suggested that

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<sup>1</sup>. W. E. Cameron, *Op. Cit.* v. 3.

the Brisbane River—or rather that part of it above Oxley Creek—which follows approximately the line of junction between the Brisbane schists and the Ipswich measures, really marks a series of fault-lines. A number of facts seem at first rather to support such an idea ; for example, the abrupt way in which the ranges rise out of the surrounding country and the fairly level summits of these ranges. The writer, however, has found several objections to such an hypothesis, and believes that the various phenomena can be better explained as the result of differential erosion.

At a point on the right bank of the Brisbane River near Corinda, a section can be seen well exposed at low-water showing the Trias-Jura beds resting unconformably on the Brisbane schist, and moreover, this section lies in the line of supposed faulting. The very gentle dips of the Ipswich beds in close proximity to the supposed lines of faulting seem also to militate against such an idea, at least for the area under discussion. The chief points in favour of the hypothesis that Taylor Range and Enoggera Range are residuals resulting from differential erosion are, first, the fact that these Ranges are composed of very resistant rocks—the granites, and schists strengthened by large intrusions—and second, the marked parallelism of the strike of the intrusives and the axis of granitic intrusion with the directions of the ranges and chief spurs. In this connection it is interesting to compare the Geological Map (Plate XI.), with that of the Physiographical features (Plate XII.)

#### iv.—THE ROCKS OF THE AREA.—GENERAL.

In the geological formations of the area, rocks of both igneous, sedimentary and metamorphic origin occur. The first are represented (1) by rocks of a granitic type—the Enoggera granites : (2) by intrusive bodies—mostly of a rhyolitic facies, but in part made up of a more truly hypabyssal type ; and (3) by flows and sills of a basaltic nature. It is with the first and second of these classes—which are probably closely related—that this paper is chiefly concerned, while such examples of the third class as occur in the area dealt with are dismissed with this brief notice.

The oldest unaltered sediments occurring in the vicinity of these igneous rocks, are the series known as the Ipswich beds. These, although they are not actually shown on the geological map accompanying this paper, occur almost immediately outside it, good sections being shown on the Brisbane River near the mouth of Oxley Creek and at Corinda. They are made of sandstones, conglomerates, and grits, interspersed with layers of shale, while almost at the base of the series is the extensive deposit of volcanic ash, known as the Brisbane Tuff. The basal beds of the system are to be seen in a number of sections in and around Brisbane resting unconformably on the Brisbane schists. They contain a rich fossil flora of mesozoic forms, a consideration of which indicates a Trias-Jura age for the formation.

Above the mesozoic sediments are a series of conglomerates, grits and clays. These beds, in which a number of fossils of dicotyledonous plants have been found, are well displayed around Sherwood, and are generally assigned to the Tertiary period.

The most recent deposits are river alluvials which are to be seen at a number of points along the banks of the Brisbane River and Kedron Brook, and to a less extent those of Enoggera and Cubberla Creeks.

The metamorphic rocks are represented by a very extensive series of altered sediments known as the Brisbane schists. These schists are extremely important in the present connection, in that it is with them that the igneous masses here dealt with are almost invariably associated. They are undoubtedly the oldest rocks in this portion of Queensland, and occupy the major part of the area under discussion. The series is made up of mica schists, slates, and shales, which have undergone a varying amount of secondary alteration by silicification. They are markedly schistose, and generally exhibit very noticeable contortion. Jensen, in speaking of these Brisbane schists, remarks that they "are so crushed, folded, foliated and faulted that they must be assigned to the middle zone"<sup>1</sup> in

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1. H. I. Jensen. A.A.A.S., 1909 p. 262.

Grubenmann's classification.<sup>1</sup> Their general strike is north-west, with a varying dip to the north-east. The age of the schists has long been a matter for considerable speculation, as even where not highly foliated, they appear to be entirely unfossiliferous. The series has at different times been assigned to the following periods:—Pre-Cambrian,<sup>2</sup> Cambrian-Devonian,<sup>3</sup> Silurian,<sup>4</sup> Devonian<sup>5</sup> and Permo-Carboniferous,<sup>6</sup> while at present it is classified by the Queensland Geological Survey as Devonian.<sup>7</sup> This classification is, however, admittedly only provisional, no conclusive evidence having as yet come to light.

#### V.—THE GRANITES.

*Location. etc.*—The rocks considered under this heading form three distinct outcrops. The largest of these is roughly oval in plan, and lies between Kedron Brook on the north, Mt. Cootha Reserve on the south, the Enoggera Reservoir on the west, and the Enoggera Rifle Range on the east. The longer axis of the oval lies in a direction N. 12° W.—S. 12° E., and measures four and a quarter miles, while the shorter axis is about two and three-quarter miles long. This principal outcrop is spoken of throughout the paper as "the Enoggera Area." About one and a quarter miles south of this occurrence, and roughly one and a-half miles west-north-west of Indooroopilly railway station, lies the second outcrop. This is sub-circular in shape, with an average diameter of about 750 yards. This may be conveniently termed the "Green Hill Area" since it lies adjacent to a hill of that name. Lying to the north-north-east of the Enoggera Area, and distant from it one half-mile, and one and a-half miles respectively, are two further outcrops of granitic rock. They are

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1. U. Grubenmann, *Die Kristallinen Schiefer*.

2. R. A. Wearne, *A.A.A.S.*, 1911.

3. H. I. Jensen, *Proc. Royal Soc. of Qld.* XXIII, p.154.

4. William H. Rands, *Op. cit.* p. 1.

5. Sir A. C. Gregory, *Report on Geological Features of S.E. Districts of Qld.*, 1879.

6. *Q'land Geological Survey Map*.

7. B. Dunstan, *Queensland Mineral Index*, Geological Survey, Queensland, Pub. No. 241, p. 144.

separated by recent alluvium merely, and there is every reason for considering them as parts of one common mass with its major axis approximately meridional, and about one and a-quarter miles in length.

If the major axis of the Enoggera Area be continued to the south, it will be seen to pass through the centre of the smaller Green Hill outcrop. Thus this direction may be considered a true axis of igneous intrusion. The Kedron Brook outcrops are so seldom seen in direct contact with the intruded schist that only a rough idea can be gained as to the real shape of the body, but as has been suggested, it, too, is probably roughly meridional.

Thus we see that, like the great granite batholiths of New England,<sup>1</sup> the axis of intrusion of the Enoggera granites differs from the strike of the older country rock,—which in both cases is almost certainly the result of folding in Permo-Carboniferous times—and seems to sympathise with the trend of the adjacent coast line. Further north, in Central Queensland, where the coast line takes the same direction as the prevailing strike of the older rocks, the granite batholiths too have this direction.<sup>2</sup> This suggests that in Queensland—or at least in Southern Queensland—the axes of intrusion belong—as in the case of New South Wales and Victoria<sup>3</sup>—to those newer trend lines, which were initiated soon after the Permo-Carboniferous folding, and which ultimately determined the position of the present coast line.

*Petrology.\**—The most marked feature of the granites of the area is their variability. This is shown mineralogically, in the nature of the constituent minerals and their relative proportions, and texturally in the grainsize and fabric of the rocks. In this peculiarity the granites resemble very closely the first of the “Later Granite Types” of

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1. T. W. E. David, Pres. Address to Royal Soc. of N.S.W., 1911, p. 36.

2. T. W. E. David, Pres. Address to Royal Soc. of N.S.W., 1911, p. 36.

3. T. W. E. David, Pres. Address to Royal Soc. of N.S.W. 1911, p. 36.

\* The Petrology of the igneous rocks of the area will be treated in greater detail in Part II of this paper.

New England, as described by E. C. Andrews,<sup>1</sup> and the "Stanthorpe" granite of Saint-Smith.<sup>2</sup> However, in the case under consideration, the various phases can all be assigned to one of two main types.

Of these types, the one which forms the major portion of the outcrop of the Enoggera Area is a rock of a fairly uniform flesh-colour, which is only relieved by a minority of ferro-magnesian minerals—these constituents, however, being very variable. Usually the rock is holocrystalline and porphyritic, with medium-sized phenocrysts of quartz, pink orthoclase, white plagioclase and black mica set in a fine-grained aplitic, flesh-coloured groundmass. Hornblende is sometimes present, but is always subordinate to the biotite. Occasionally the porphyritic character disappears, and in its place appears a medium-grained holocrystalline rock, which in all other respects resembles the normal type. In this rock the orthoclase is slightly in excess of the plagioclase, while in the commoner porphyritic phase the plagioclase phenocrysts are considerably in excess of the orthoclase. This apparent diversity is however compensated for in the groundmass of the latter type, which is rich in orthoclase. The accessory minerals usually present are apatite in considerable amount, magnetite, and zircon. Pyrites is usually absent. From this short description the rock is evidently comparable in structure and mineralogical character with specimens of a granite from Bolivia which is described by Mr. G. W. Card,<sup>3</sup> and is a representative of the great "Acid" series of New England granites, and also with the "typical 'Acid'" granite described by him.<sup>4</sup>

The second type of granitic rock met with in the Enoggera Area, is usually considerably less acidic than that just described, it has a much greater proportion of ferro-magnesian minerals (often in two generations). has

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1. New England Geology. Records of Geol. Survey of N.S.W. Vol VIII. Part 2, pp. 116-117.

2. Geology and Mineral Resources of the Stanthorpe, Ballandean and Wallangarra District. Qland. Geol. Survey Pub. No. 243, p. 39.

3. Geol. Survey of N.S.W. Records, Vol. VIII, p. 219.

4. Mineral Resources of N.S.W., No. 14, p. 23.

hornblende usually in excess of biotite, is lacking in pink orthoclase, and contains a marked quantity of pyrites. Like the former type, it varies somewhat both texturally, and in the proportions of its constituent minerals. For convenience this phase of the granites may be called the granodiorite type. This variety usually occurs as segregations in the former (using the term in its broadest sense), these segregations varying in size from patches a few square inches in area to huge masses covering many square yards. A common size measures about ten feet in diameter. These segregations do not favour any particular shape, rounded, angular, and very irregular patches, all being common. Larger outcrops of this granodiorite type also occur, one area in the north-western portion of the mass measuring some acres in extent.

In connection with this natural division of the granites into these two fairly distinct groups, it is interesting to quote Saint-Smith on the "Stanthorpe" granite. "Speaking generally," he writes, "the 'Stanthorpe' granite is characterised by a markedly pink colour, due to the abundance of pink orthoclase felspar, which is seen through the rock. This colouration does not, however, persist over the whole area examined, for at Wilson's Downfall the rock has a preponderance of long, white felspars having a marked orientation. So pronounced is the difference between these two varied types of the same rock-mass. . . ."<sup>1</sup>

The Green Hill Area is composed of rocks of the first or adamellite type. They are for the most part very acid, of a pink colour, and consist of phenocrysts of quartz, pink orthoclase, white plagioclase, biotite, and a very little hornblende, set in a fine-grained pink aplitic groundmass.

The Kedron Brook Area differs from the one just described in that it contains rocks which bear a general resemblance to the granodiorite type of the Enoggera Area. They contain plagioclase in excess of orthoclase, the pink variety of the latter mineral being entirely absent. They vary in colour from light to dark grey, but are all fine-grained porphyritic rocks. Both pyrites and pyrrhotite occur as accessory minerals.

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1. Op. cit. p. 40.

*Intrusions in the Granite.*—The majority of the dykes found penetrating the granitic rocks can be divided into two distinct classes, viz., dark porphyritic rocks, and light coloured aplites. Several examples of the former type can be seen in the cuttings along the Waterworks Road. They vary in width from a few inches to about fifteen feet. A fairly typical example of this class occurs in the granite quarry off the Waterworks Road. This is about nine inches wide, is dense, heavy, grey in colour, and made up of phenocrysts of a light brown (altered) plagioclase and small patches of secondary quartz set in a very fine-grained felsitic groundmass. Scattered throughout the rock are segregations of pyrites up to 5 m.m. in diameter. The other dykes of this type differ chiefly in the proportion of the phenocrysts to the groundmass, this ratio being very variable. These intrusions are similar in their general characteristics to those considerably larger dykes outside the granite to be described later as the "Porphyries."

The aplitic dykes are considerably more numerous than the porphyritic. They generally occur somewhat near the contact of the granite with the schist, where they are frequently associated with pegmatites. These latter vary from rather coarse-grained rocks—with crystals of orthoclase, about two inches long—to micropegmatites, whose typical structures can only be observed with the microscope, and are often found near, and probably connected with, large masses of quartz. The aplites themselves are, as a rule, very fine-grained. They vary considerably in colour—different examples being white, light brown, pink and red—and are generally almost entirely free from ferro-magnesian minerals. A rather different type of rock, but one which probably belongs to the same phase, is also met with. This occurs well within the granite, in large irregular masses. It is a little coarser grained than the typical aplites, and is generally red in colour. It frequently contains small blebs of quartz as phenocrysts and abundant black tourmaline arranged in stellate groups of small acicular crystals. In this and other points this rock seems to resemble rather closely the aplitic dykes intrusive into the Acid Granite of New England, as

described by Leo. A. Cotton.<sup>1</sup> Such an intrusive mass is to be seen on the summit of Mt. Enoggera, which is the highest point in the area. This particular occurrence appears to grade into a biscuit-coloured fine grained rock, containing a noticeable amount of biotite. This phase is interesting since in it the writer has discovered flakes of molybdenite arranged along the joint planes. Other rocks which should be mentioned here are the typical greisen, which occurs near the Enoggera Reservoir, and in Portion 856, Parish of Enoggera

Considered both as a whole and in detail, this aplitic phase corresponds closely to the group of intrusives which followed almost immediately the appearance of the "Acid" and "Stanthorpe" granites of New England and Stanthorpe respectively.<sup>2</sup>

*Contact Phenomena.*—A study of the contact phenomena associated with the intrusion of the granites brings to light a number of interesting facts. The changes brought about by such intrusion vary in an apparently arbitrary manner from place to place, and are often quite local in character. As the main mass of granite is approached from the east, the schists, which normally strike in a north-westerly direction, are seen to gradually change in strike, until, when near the intrusive mass, they lie roughly parallel to the adjacent edge of the granite. A similar phenomenon is observed when the Enoggera granite is approached from the west, but in this case the dip itself is reversed, the schists to the west and south-west of the granite dipping to the west and south-west respectively. Numerous dips have been observed, and in nearly every case the schist is seen to lie parallel to the edge of the granite, and to dip away from it. For the smaller Green Hill and Kedron Brook areas this generalisation does not seem to hold, for in each of these cases the strike of the schist seems to have been only locally affected by the intrusion of the magma. Indeed, in the case of the former area, quite a different type of structural change is brought about. This involved the

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1. The Tin Deposits of New England, N.S.W. I. Proc. Linn. Soc. of N.S.W., 1909, p. 745.

2. Compare the works of Andrews, Carne, Cotton, and Saint-Smith already cited.

brecciation and grinding-up of the schist, and examples can be seen at a number of points outside the periphery of this intrusion. The breccia is made up of angular fragments of schist of various sizes, but seldom exceeding one inch in length, set in a finely-powdered ground mass. This rock, as the granite is approached, gradually shades off into a hornfels showing traces of the agglomeritic structure, which in turn is succeeded by a more normal hornfels.

The mineralogical and textural changes induced in the schists not only vary in the different areas considered, but vary at different contacts of the same intrusive mass. In general, as the granite is approached, the quartz veins, which form a noticeable feature even in the normal schist, become more frequent, until in close proximity to the granite, the whole rock seems to have been silicified and hardened. A marked textural change is to be seen near the Enoggera Reservoir where the heat resulting from the intrusion has converted the normal micaceous schist—already somewhat siliceous—into a hard black hornfels. On the north-north-west edge of the main granite area, and twenty-five yards outside the actual contact, on the Cedar Creek Road, there is a band of rock about two feet in thickness, showing the typical schistose and contorted structure of the Brisbane schists, but made up almost entirely of tourmaline and felspar arranged in definite bands. The tourmaline—which is the black variety schorl—is present as numerous minute acicular crystals all arranged with their long axes parallel to the planes of schistosity, and seems to have taken the place of the micaceous part of the schist, while the felspar seems to occupy the spaces previously occupied by the small veins of quartz. The whole schist has been so beautifully replaced that the new rock under the closest scrutiny shows every characteristic of the normal schistose structure. Nearer the granite, and almost right on the contact itself, is a larger body of schorl rock composed entirely of tourmaline in the same slender crystals, but in which the original schistosity is only faintly recognisable. This rock contains cavities which are partly filled with well-shaped quartz crystals with

an occasional crystal of pyrites. Small patches of tourmaline are also found in the schist over fifty yards from the contact.

A noticeable textural change in addition to that from schist to hornfels already described, and one that is well developed round the Green Hill Area, is that from the typically schistose to the typically gneissose. This is well shown in the creek bed in the south-east corner of portion 310, parish Indooroopilly. Here, when about one hundred yards from the contact with the Green Hill granite, the schist takes on a gneissose character. The ferro-magnesian minerals are gathered together in long, black, well-defined bands varying from less than one millimetre to over two centimetres in width. These bands appear under the microscope as masses of small fresh crystals of biotite, the rest of the rock being occupied by lenticular streaks of white quartz, which, when examined by the same means, is seen to have undergone recrystallisation.

Chemical changes resulting from absorption of the invaded schists by the granites, or allied phenomena, seem to be almost entirely wanting. With but one exception, the contact between the schist and the igneous rock is very sharp and clearly defined. There seems to be no evidence to show that assimilation of the invaded formation by the intruding magma has taken place. The one possible exception is seen in the creek bed in portion 229, parish of Indooroopilly, where between the granite—which is considerably less acid than normally at this point—and the hornfels—by which the schist is here represented—there is a distinct glassy band of a yellow colour and measuring half an inch in thickness. On examination with the microscope this band proves to be made up of irregular crystals of quartz one-half to three millimetres in length arranged at right angles to the line of contact, with—filling the spaces between them—aggregates of a sericitic mica. The granite in the immediate neighbourhood of this band is considerably darker than the normal pink type. This is due to the facts that the aplitic groundmass has almost disappeared and the proportion of

primary biotite has considerably increased. The chlorite resulting from the decomposition of this mineral also tends to make the rock abnormally dark.

A matter which is closely connected with the phenomena of contact metamorphism is the presence of fragments of the country rock in the invading magma. Such inclusions though very rare have been found on the edge of the large Enoggera mass. They are much more numerous in the Green Hill Area, a good development occurring in the creek bed in the south-east part of portion 310, parish of Indooroopilly. Here the granite near the actual contact contains numerous inclusions of schist, or rather of a gneissose rock similar to the altered schist in the neighbourhood of the contact. The largest of these fragments measures only about one foot in length. The edges of these inclusions show a slightly darker band from 1.5 to 2 millimetres in thickness, otherwise they are entirely unaltered, preserving a very definite outline strongly contrasted against the enclosing granite, and internally in no way different from the adjacent country rock. The inclusions seem limited to a narrow zone at the edge of the granite, none having been found in the more central portions of the mass. In this connection, it is interesting to note that Daly's Zone of Apophyses<sup>1</sup>—that belt "more remote from the intrusive body" than the Zone of Inclusions and consisting of "country rock intersected by more or less numerous apophyses from the main igneous mass" is quite wanting, the contact of granite and schist even in the neighbourhood of the inclusions being quite regular.

In considering the various changes outlined above, there is one fact of observation which is highly interesting. It is that the phenomena of metamorphism resulting from the intrusion of the large mass seem to be more widely spread but less intense in character than those of the smaller Green Hill mass. The chief change caused by the larger intrusion was the alteration in the strike of the intruded rocks and their general hardening. The more pronounced meta-

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1. The Mechanics of Igneous Intrusion (Second paper) Amer. Jrnl. of Sci., August, 1903.

morphism resulting in the formation of gneissose textures, in brecciation and the tearing off—by whatever means—of fragments of the wall rock, occurs around the smaller mass, which however does not seem to have influenced the strike of the schists to any very noticeable extent.

*Mode of Intrusion*—Of the three principal theories at present put forward to account for the intrusion of granitic magmas, the Marginal Assimilation theory, which is supported by some French geologists, suggests chemical energy as the chief factor in the intrusion; the Overhead Stopping Hypothesis of R. A. Daly<sup>1</sup> considers heat energy to be the all-powerful agent, while the Laccolitic Theory, advanced by Harker,<sup>2</sup> Brögger<sup>3</sup> and many others, relies chiefly on mechanical energy.

If the above hypotheses be applied to the present instance, it will be seen that the evidence in general supports the Laccolitic method of intrusion for at least the large Enoggera mass, as witness the following facts.

The schists near the contact strike parallel to and dip away from the granite. Here, obviously, great mechanical energy must have been called into play, either in the preparation by folding movements of a cavity or plane of weakness in the schists into which the magma found its way (forming the "phacolite" of Harker<sup>4</sup>) or—and this seems more probable, since the long axis of the intrusion is not sympathetic with the strike of the schists—in the actual lifting up of the schist cover by the invading magma itself to form the typical laccolite.

The contacts of schist and granite are always very sharply defined. Traces of assimilation are quite lacking and hence the Assimilation Hypothesis seems out of the question.

There is an almost complete absence of inclusions, such few as are found showing no trace of absorption by the magma. Further there is, too, an absence of what Daly terms the Zone of Apophyses. These facts militate against

1. Mechanics of Igneous Intrusion. Am. Jour. Sc., April, 1903.

2. Natural History of Igneous Rocks, p. 82. et seq.

3. Eruptivgesteine des Kristianiagebietes, II, pp. 116-153.

4. Op. cit. p. 77.

the Overhead Stopping Hypothesis, since this postulates a fracturing of the invaded rock followed by the injection of long sinuous apophyses of low viscosity into the fractures, as the essential features of the growth of the intrusion.

The ground-plan is that of a typical laccolite, as are the proportionate lengths of the major and minor axes, that is 3:2.<sup>1</sup> While it is impossible from the limited vertical section exposed to observation to classify this igneous body strictly according to its shape—as Daly would have it—these facts taken into conjunction with the probable method of intrusion seem to point to the *shape* of this occurrence as that of a true laccolite. Similar laccolites of Plutonic rock have been described from a number of places,<sup>2</sup> while Brögger explains much larger areas of granite as laccolites.

In the considerably smaller Green Hill Area, the phenomena seem to resemble more closely those which one would expect as the result of "overhead stopping." The dips of the schists seem to be almost independent of the granite mass. Inclusions are fairly common and answer very well to the description of those found in Daly's type localities,<sup>3</sup> but here again the Zone of Apophyses is wanting. Assimilation is present in this area but on such an exceedingly small scale as to show its practical insignificance to the problem in hand. Yet even in this area mechanical energy has played an important part as witness the schist breccia with its finely-ground base which is so characteristic a feature of this intrusion.

*Age of the Granites*—Unfortunately, work done up to the present can throw very little direct light on the exact age of the Enoggera granites. They undoubtedly intrude the Brisbane schists, as the various contact phenomena plainly show. Further, the included fragments in the granite are inclusions of schists, not of unaltered sediments, so that the movements producing the schistosity occurred before the intrusion of the granite. Again, the axis of intrusion cuts across the axis of folding, the two

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1. G. K. Gilbert, *Geology of the Henry Mountains*.

2. *Mechanics of Igneous Intrusion*, p. 272.

3. Alfred Harker *Op. cit.*, pp. 65, 67 and 82.

directions making an angle of thirty degrees, so that the latest folding of the schists also antedated the appearance of the granites.

Unfortunately, the age of the Brisbane schists themselves is still in the region of doubt, but there seems little reason to doubt that they are early Palæozoic sediments, and that the folding referred to took place in late Palæozoic—probably, Permo-Carboniferous—times.

Although the granites lie in such close proximity to the Ipswich beds, neither they, nor any of the allied, but somewhat later, intrusives intrude these strata. Since the Brisbane representatives are the basal members of the Ipswich series, and since this is the lowest division of the Trias-Jura, the granites are probably pre Trias-Jura. These facts, though slight, point to the probability that the granites are late Permo-Carboniferous in age.

If we now resort to less direct methods and consider the evidence gained by a correlation of these granites with those of other areas, a practically identical result is arrived at. From a study of the works of Andrews, Carne, and Cotton on the New England granites, the writer has come to the conclusion that in spite of superficial differences the Enoggera granites resemble very closely, and are probably related to in point of time, the granites which Andrews considers under his "Later Granite Types" or "Acid" granites which are identical with the Stanthorpe granites. The chief grounds for this conclusion are, the general mineralogical similarity,<sup>1</sup> the marked variability of the rocks of both areas—Andrew's description<sup>2</sup> might be applied word for word to the Enoggera granite—the absolutely sharp lines of demarcation between the granites and the invaded rocks,<sup>3</sup> the association of each of the granites with somewhat later finer-grained aplitic types, lacking in ferromagnesian constituents and containing black tourmaline and molybdenite<sup>4</sup> and the further association of the granites with rhyolitic intrusions, quartz porphyries, and porphyries.<sup>5</sup>

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1. Card Mineral Resources of N.S.W. Records, Vol. VIII., p. 23.

2. *Op. cit.* p. 113.

3. Andrews, *Op. cit.* p. 232.

4. Andrews, *Op. cit.* p. 232.

5. Andrews, *Op. cit.* pp. 117, 128.

These later "Acid" granites of New England have been considered by different observers to be Permo-Carboniferous,<sup>1, 2</sup> "Early Mesozoic,"<sup>3, 4</sup> and Mesozoic<sup>5</sup> in age. A consideration of these opinions and especially the more recent ones seems to point to late Permo-Carboniferous as being the most probable age of intrusion.

Assuming then that the Enoggera granites and the "acid" granites are related as regards time of intrusion, this result gives weight to the decision, already formed on purely local evidence, that the granites are late Permo-Carboniferous, which may then be supposed to approximate the truth.

#### vi. THE RHYOLITIC INTRUSIVES.

This is the name given to an extensive series of intrusives which occurs throughout the area, the great majority of them however, lying to the south of the main granite outcrop. The rocks which come under this head vary considerably, but are as a rule light in colour, the commonest shades being white, light brown and grey. They include intrusive rhyolites, felsites and fine-grained granophyric rocks. They are frequently porphyritic—the phenocrysts generally being orthoclase—but in no case is this structure pronounced. Well marked fluxion structure is very common, especially in the more acid varieties. A feature which is characteristic of the group is its mode of weathering. Almost without exception the rocks weather into very angular fragments with sharp edges. The planes along which the rocks break intersect each other at all angles, the cracks generally being filled with limonite. In this respect the group is very strongly differentiated from the younger porphyries to be described later. A common mode of alteration in these intrusives is caused by the continuous passage of siliceous waters through them. The rocks thus attacked gradually become more and more

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1. Federal Hand-book, B.A.A.S.

2. Andrews in the Hand-book of N.S.W., issued for B.A.A.S., p.

3. Carne, Op. cit. (on maps).

4. Andrews, Op. cit. p. 113.

5. Carne, Op. cit.

siliceous, until at last they resemble very closely some quartzites. A good example of such an altered rock is to be seen in the quarry at Corinda.

As regards mode of occurrence these rocks are found both as dykes, sills and laccolites. Examples of the first type are very common, the great majority of the smaller intrusions being of this nature. Sills, though not so plentiful have been observed at a number of points throughout the area, the large intrusion in portion 684, parish Indooroopilly probably being of this nature.

A good example of the laccolitic type of intrusion is to be seen on the northern edge of the Mount Coottha Reserve. This large mass is now considerably dissected by young streams, but enough remains to show that it is a laccolite. The level of its base—470 ft. above sea level—is wonderfully constant. A small patch of schist still caps the top of the intrusion which is 590 ft. above sea level, giving a thickness of 120 feet for the intrusion. As far as can be determined the laccolite measures about 550 yards in length, the ratio of height to length being approximately 1 : 14. Another splendid example of this type of intrusion occurs at Indooroopilly. Here on the left bank of the Brisbane River, just below the Albert Bridge, is to be seen an oblique section across the end of a laccolite. The schists can be observed dipping away from the intrusion on both sides, while the jointing of the intrusion itself forms a pronounced curve with its convexity upwards since it seems to follow the outline of the intrusion itself. This particular intrusion can be followed for nearly a mile in a north-westerly direction, but the outcrop is merely a small portion of the top which has been exposed by the erosion of the overlying schist.

At first sight, the rhyolitic intrusions seem to lack uniformity of direction, but a study of the map, together with numerous observations in the field, show that there are two or three directions which are particularly favoured. These are west-north-west, north-west, and north-north-west. Those falling under the first and second directions seem to run more or less in the general direction of the strike of those schists, and are well illustrated by the large intrusion at Indooroopilly just discussed. The last direct-

ion is shown by a series of disconnected dykes, which, breaking across the strike of the schists extend from the cross roads at Indooroopilly school to the carriage drive in Mt. Cootha Reserve, the line of intrusion in this case being almost parallel to the axis of intrusion of the granites.

An interesting feature in connection with these rhyolites is the fact that some of them have been found to be slightly auriferous. Mr. Rands<sup>1</sup> refers to an intrusion—probably that in the road cutting near Indooroopilly school—in which “very minute specks of gold were visible.” An assay of an average sample, however, “gave but a mere trace of the precious metal.”

#### vii. THE PORPHYRIES.

This is a field name given to a series of rocks, which differ in many respects from the rhyolitic dykes. They form a distinctive type, and seem to be the result of a rather later series of intrusions than that which produced the more acid rocks. The rock is readily recognised in the field since it always weathers into black, rounded boulders, somewhat rough and pitted on the outside. It is thus easily distinguished from the sharp angular fragments resulting from the weathering of the other more acid type of intrusion. The typical rock is porphyritic with numerous phenocrysts of idiomorphic feldspar—brown from alteration—showing zoning in the hand specimen, and a few smaller phenocrysts of quartz set in a brown or grey felsitic ground-mass.

The rock easily undergoes decomposition, making it extremely difficult to collect fresh specimens. Under the microscope, the quartz phenocrysts are seen to have rounded outlines, to be deeply corroded and to be surrounded by marked reaction rims. The feldspar is very altered being replaced by an aggregate of muscovite and similar secondary minerals. In spite of this alteration the idiomorphic outlines of the original crystals are still definitely preserved. Both the feldspar and quartz phenocrysts are very similar

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1. Op. cit. p. 1.

to those observed in a quartz-porphry which outcrops in the bed of Ithaca creek, and which in most other respects resembles the rhyolite rocks. It thus seems to form a connecting link between these two very different types of rock.

A series of intrusions which are very similar to the porphyries have already been described as intruding the granite itself. The porphyries seem then to be younger than the granites, and as they also break through an important chain of rhyolitic dykes on the southern boundary of Mt. Cootha Reserve, they are younger too than this group of intrusions.

There are two principal outcrops of the porphyry. One is roughly parallel to Taylor Range, and outcrops near the top of the ridge which it occasionally crosses, thus probably forming the backbone which has preserved this part of the range as a residual. The general direction taken by this intrusion is thus north-west—south-east. The only other really extensive intrusion of this rock occurs as a series of outcrops about one mile to the west of the Green Hill granite. Here the individual outcrops and the intrusion as a whole seem to strike almost due north, again sympathising with the long axis of the granites.

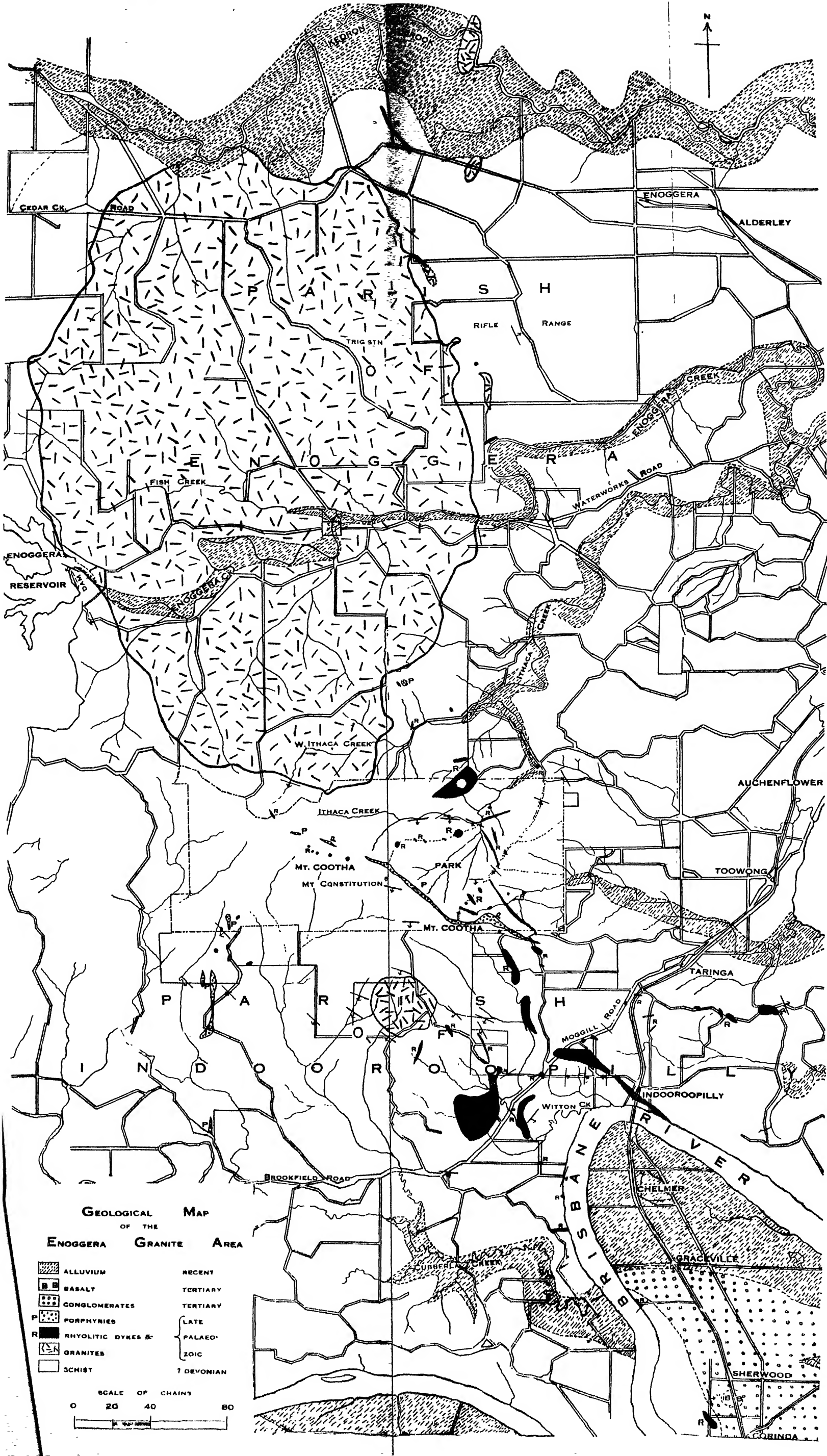


I would like here to express my gratitude to Mr. Richards and Mr. Walkom of the Department of Geology in the University of Queensland, for the help and advice which they were ever ready to offer me in connection with the preparation of this paper, and their kindly encouragement throughout the whole of the work.

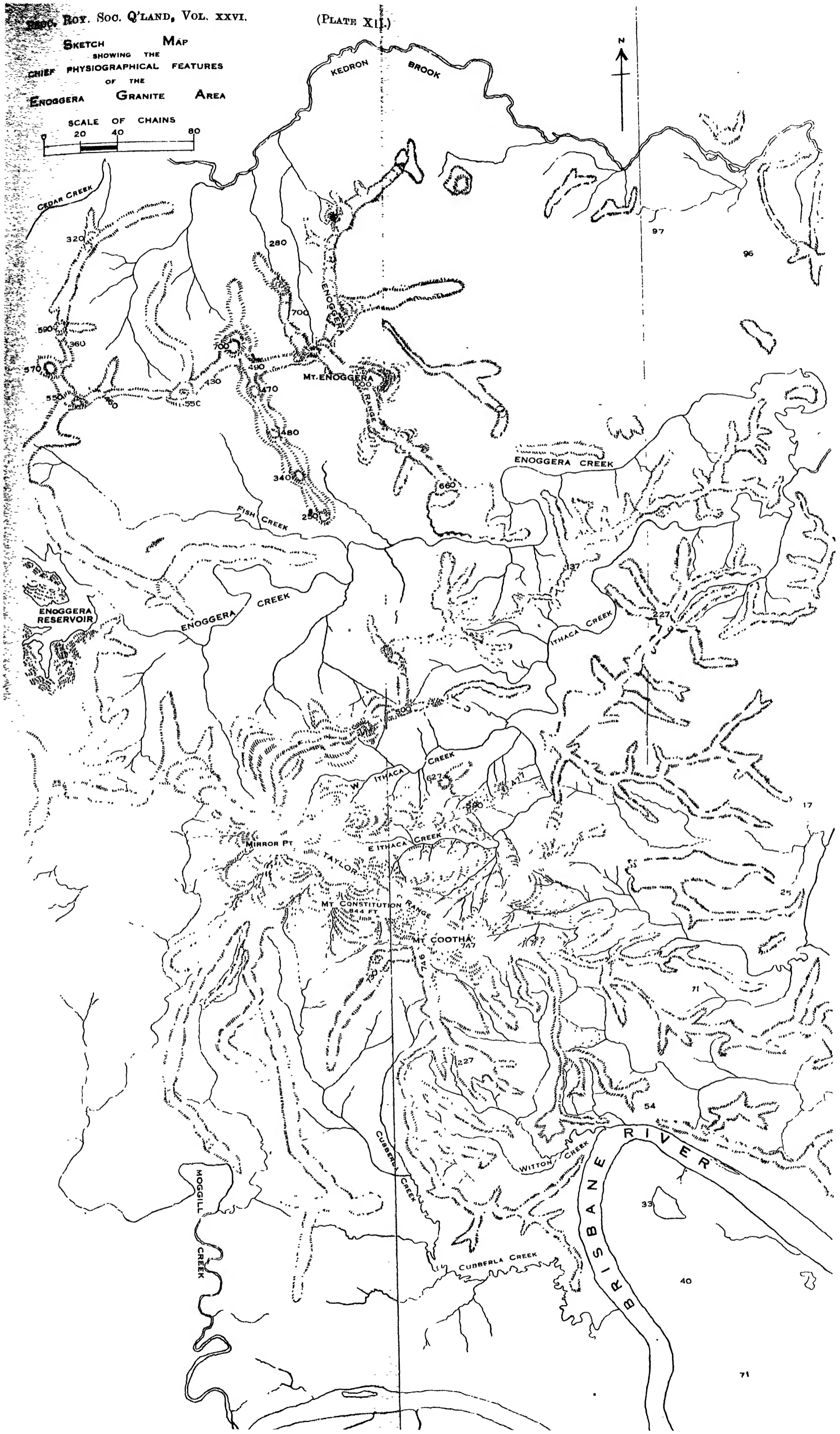
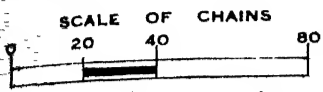
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SKETCH MAP  
SHOWING THE  
CHIEF PHYSIOGRAPHICAL FEATURES  
OF THE  
ENOGGERA GRANITE AREA







## **Abstract of Proceedings of the Royal Society of Queensland**

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ABSTRACT OF PROCEEDINGS, MARCH 30TH, 1914.

The Annual General Meeting of the Society was held at the University at 8 p.m

Mr. H. C. Richards, President, in the chair

Twenty-four members and a number of friends were present.

The minutes of the preceding Annual Meeting were read and confirmed.

The Secretary read the Report of the Council as follows :—

“ Eight Ordinary Monthly Meetings and nine Council Meetings were held during the year.

“ During the year six members were admitted, four died, and fourteen resigned : of the latter some had left the State ; others were hampered by increasing age.

“ It will thus be seen that we have had unusually heavy losses by death during the past year. Of these, the Hon. A. Norton, M.L.C., was a Trustee of the Society, and an indefatigable worker in its interests. He was the means of adding many new and valuable members to the Society, and his presence on deputations was invaluable. Mr. Jno. Sutton was President in 1899 and a prominent officer and worker in bygone years, till advancing age restricted his attendance. The Hon. R. M. Collins was one of our best pioneers, and took a general interest in every laudable object. The Hon. Alex Raff was, as a member of the Philosophical Society, a life member of

our Society. A letter of condolence was sent to the relatives of the Hon. R. M. Collins, and the same course is to be pursued in regard to Mr. Sutton and the Hon. Albert Norton.

“ We have now on our roll 14 honorary members and 100 ordinary members.

“ Vol. XXIV of our Proceedings was issued during the year, and proved of great value. Dr. T. Harvey Johnston, D.Sc., our Honorary Librarian, was awarded the Syme Research prize during the year.

“ The forthcoming volume will, on the whole, scarcely be equal to the average issue. Our more prominent members have been too busy with routine work and unavoidable official duties, and we have not been as fortunate as usual in chance contributions. The outlook for the present year is, however, promising, though the visit of the British Association for the Advancement of Science may absorb some of our members' time and energies.

“ During the absence of Dr. Harvey Johnston, on the Prickly Pear Commission, the Library exchanges have been under the care of Mr. C. D. Gillies, and have been well looked after.

“ In accordance with the wishes of the Honorary Auditor, the books were closed on December 31st instead of at a later date, as was usual of recent years. This reversion to the previous custom makes our credit balance seem lower, but the financial position of the Society is quite satisfactory. There are some outstanding subscriptions (about £34) to come in, and it would facilitate the work of the Council if these and the present year's subscriptions were forwarded early, as it is intended to issue the Proceedings at once, the President's Address and this Report appearing in the next volume according to resolution.

“ During the year a Sub-section was formed to deal with the interests of Forestry.”

This report was adopted on the motion of Dr. J. Shirley, seconded by Mr. C. W. Costin.

The following financial statement was presented by the Hon. Treasurer (Mr. J. C. Brünnich) and adopted.

| RECEIPTS.  |    |    |    |    |    | £           | s.       | d.       |
|--|----|----|----|----|----|-------------|----------|----------|
| To Balance from 1912                             | .. | .. | .. | .. | .. | 40          | 0        | 8        |
| „ Admission Fees and Subscriptions               | .  | .  | .  | .  | .. | 72          | 10       | 0        |
| „ Sale of Proceedings                            | .. | .. | .. | .. | .. | 2           | 5        | 0        |
| „ Sundry Small Receipts                          | .  | .. | .  | .. | .. | 0           | 1        | 10       |
| „ By Secretary (Petty Cash)                      | .  | .  | .. | .. | .. | 0           | 2        | 9        |
|  |    |    |    |    |    | <u>£115</u> | <u>0</u> | <u>3</u> |
| EXPENDITURE.                                     |    |    |    |    |    | £           | s.       | d.       |
| By Printing (Pole & Co.)                         | .. | .. | .. | .. | .. | 72          | 12       | 7        |
| „ Postage of Monthly Notices                     | .. | .. | .. | .. | .. | 4           | 9        | 2        |
| „ Postage of Proceedings and Librarian's Postage | .. | .. | .. | .. | .. | 5           | 10       | 0        |
| „ Postage on Circulars                           | .. | .. | .  | .. | .. | 0           | 7        | 6        |
| „ Insurance                                      | .. | .. | .. | .. | .. | 1           | 2        | 6        |
| „ General Postage and Petty Cash                 | .. | .  | .. | .. | .. | 5           | 17       | 11       |
| „ Caretaker and Refreshments                     | .. | .. | .. | .. | .. | 3           | 11       | 0        |
| „ Landing Charges                                | .. | .. | .. | .. | .. | 0           | 12       | 9        |
| „ Refund to Hon. Secretary                       | .. | .. | .. | .. | .. | 0           | 12       | 0        |
| „ Tea Urn, Cups, Saucers, Spoons, etc.           | .. | .. | .. | .. | .. | 1           | 3        | 0        |
| „ Bank Charges                                   | .. | .. | .. | .. | .. | 0           | 10       | 0        |
| „ Balance as per Bank Book                       | .. | .. | .. | .. | .. | 18          | 11       | 10       |
|  |    |    |    |    |    | <u>£115</u> | <u>0</u> | <u>3</u> |

Examined and found correct.

GEO. WATKINS, Hon. Auditor.

BRISBANE, January 30th, 1914.

J. C. BRÜNNICH, Hon. Treasurer.

The President then delivered the Annual Address.

Dr. J. Shirley moved, and Mr. D. Eglinton seconded, a vote of thanks to the President.

There being no other nominations, the President declared the following gentlemen elected for the coming year :—

President, J. Shirley, D.Sc.

Hon. Treasurer—J. C. Brünnich, F.I.C.

Hon. Secretary—F. Bennett.

Hon. Librarian—T. Harvey Johnston, M.A., D.Sc.

Asst. Hon. Librarian—C. D. Gillies.

Members of Council—E. H. Gurney, H. C. Richards, M.Sc., A. B. Walkom, B.Sc., P. L. Weston, B.Sc., B.E.

Mr. G. Watkins was elected Auditor on the motion of Dr. J. Shirley, seconded by Mr. J. C. Brännich.

Mr. R. H. Roe was elected a Trustee (in the place of the Hon. A. Norton, M.L.C., deceased) on the motion of Dr. J. Shirley, seconded by Mr. F. Bennett.

Mr. Richards, the outgoing President, then installed Dr. Shirley as President for the coming year, and the latter returned thanks to the members.

#### ABSTRACT OF PROCEEDINGS, APRIL 27TH, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Mr. H. C. Richards in the chair.

The minutes of the previous meeting were read and confirmed.

*The following papers were read :*

1. The Composition of the Oil of Prickly Pear Seed (*Opuntia* spp.), by Frank Smith, B.Sc., F.I.C., and L. A. Meston.
2. Some Oil-bearing Seeds Indigenous to Queensland.
  1. The Seed of *Macadamia ternifolia* and its Oil. by Frank Smith, B.Sc., F.I.C., and L. A. Meston.

The discussion on these two papers was taken part in by Messrs. Bennett, Gurney, and Longman, and the President.

3. Notes on a Plant-bearing Common Black Opal from Tweed Heads, N.S.W., by Ernest W. Skeats, D.Sc., A.R.C.S., F.G.S. (communicated by Mr. H. C. Richards.)

#### ABSTRACT OF PROCEEDINGS, MAY 25TH, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Dr. J. Shirley, President, in the chair.

The minutes of the previous meeting were read and confirmed.

Messrs. E. C. Saint-Smith, A.S.T.C., and L. A. Meston were proposed as members.

*The following paper was read :*

Radiogenesis in Evolution, by H. A. Longman.

A discussion followed in which Dr. T. H. Johnston, Dr. Jefferis Turner, Dr. F. Hamilton-Kenny, Messrs. Brännich, T. Parker and Bennett, and the President took part

Dr. T. Harvey Johnston was welcomed back after his tour with the Prickly Pear Commission.

#### ABSTRACT OF PROCEEDINGS, JUNE 29th, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the School of Arts, at 8 p.m.

Dr. J. Shirley, President, in the chair.

The minutes were deferred to a future meeting.

Miss Alison J. Greene, and Messrs. E. C. Saint-Smith and L. A. Meston, were elected members.

*The following papers were read :*

1. Cactæ or Prickly Pears, by J. Shirley, D.Sc., and C. A. Lambert.

Professor Skertchly, Messrs. J. F. Bailey, Brännich, and Tryon, and Dr. T. Harvey Johnston took part in the discussion.

2. Notes on the Marine Mollusca of Queensland. Part III. By J. Shirley, D.Sc.

#### *Exhibits.*

Mr. J. F. Bailey exhibited, on behalf of His Excellency Sir William MacGregor, botanical specimens obtained by the Peary Expedition of 1908.

Mr. Dunstan exhibited, also on behalf of His Excellency, geological specimens obtained by the same Expedition : also gold specimens from Gympie.

Mr. Dunstan also exhibited specimens collected by Mr. Blake during the Australasian Antarctic Expedition : and also specimens of the siliceous sponge, *Purisiphonia*, from the Rolling Downs Formation at Wallumbilla.

#### ABSTRACT OF PROCEEDINGS, AUGUST 14th, 1914.

The ordinary general meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Dr. J. Shirley, President, in the chair.

The minutes of the two previous meetings were read and confirmed.

The appointment, by the Council, of Mr. A. B. Walkom as Hon. Editor of the Proceedings was confirmed, on the motion of Dr. T. H. Johnston, and Mr. H. A. Longman.

Miss H. Cleminson, B.Sc., was proposed as an Associate member.

The President announced that a preliminary meeting had been held in connection with the formation of a Biology Section, and that details were to be laid before the Council of the Society at its next meeting.

*The following papers were read :*

1. Some Oil-bearing Seeds Indigenous to Queensland. I. The oil of *Callophyllum inophyllum* (Domba Nut). II. The oil of the seed of *Hernandia bivalvis* (Grease Nut). IV. Note on Queensland Candle-nut Oil. by Frank Smith, B.Sc., F.I.C.

Remarks were made by Messrs. Bagster, Hargreaves and White.

2. A note on the Precaval System of *Hyla cœrulea*, White. By C. D. Gillies, B.Sc.

Remarks were made by Dr. T. Harvey Johnston, Miss Bage and the President.

*Exhibits :*

Mr. Frank Smith exhibited a series of fruits and oils illustrating his paper.

The President exhibited specimens of *Callophyllum inophyllum* and *Hernandia bivalvis*.

Dr. T. Harvey Johnston exhibited specimens of Trematodes (see p. 69 of Proceedings).

#### ABSTRACT OF PROCEEDINGS, SEPTEMBER 28TH, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Dr. J. Shirley, President, in the chair.

The minutes of the previous meeting were read and confirmed.

Miss H. Cleminson, B.Sc., was elected an Associate member.

Mr. A. P. Dodd was proposed as an ordinary member.

*The following paper was read :*

Additions to the Rotifera of Queensland, by W. R. Colledge.

The paper was illustrated by a series of lantern slides. Miss Bage, Mr. Longman, Dr. T. H. Johnston and the President. took part in the discussion which followed.

*Exhibits :*

Dr. T. Harvey Johnston and Mr. C. D. Gillies exhibited under the microscope a number of living "vinegar eels," *Anguillula aceti*, from vinegar. The exhibit was obtained in Brisbane.

Mr. W. R. Colledge exhibited a number of Rotifers under the microscope.

#### ABSTRACT OF PROCEEDINGS, NOVEMBER 9th, 1914.

The monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Dr. J. Shirley, President, in the chair.

The minutes of the previous meeting were read and confirmed.

Mr. Alan P. Dodd was elected a member.

The President announced the action taken by the Forestry Section (see proceedings of Forestry Section).

He also announced that the Council had selected Dr. W. F. Taylor as Trustee in the place of Mr. John Cameron, deceased. Dr. Taylor had signified his willingness to act, and his appointment was confirmed by the meeting.

*The following papers were read :—*

1. Further new genera and species of Australian Proctotrypoidea, by Alan P. Dodd.

The paper was communicated by the President. Remarks were made by Mr. Colledge, and Dr. T. Harvey Johnston.

2. The freezing point of some Abnormal Milks, by J. B. Henderson, F.I.C., and L. A. Meston.

Messrs. L. A. Meston, and F. Smith offered remarks.

3. Some new Queensland Endoparasites, by T. Harvey Johnston, M.A., D.Sc.

Remarks were made by Mr. H. A. Longman.

ABSTRACT OF PROCEEDINGS, NOVEMBER 30TH, 1914.

A special general meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Mr. T. R. Pearce was proposed as a member.

The rules as revised by a sub-committee of the Council were submitted to the meeting for approval, and were adopted without further alteration.

*The following paper was read :*

The Geology and Petrology of the Enoggera Granite and the Allied Intrusives, by W. H. Bryan, B.Sc.

Remarks were made by Messrs. Richards and Walkom, and Dr. Shirley.

The President announced that the proceedings for the present year would be ready in December.

*Exhibits :*

Dr. T. Harvey Johnston exhibited under the microscope some interesting fresh water Protozoa, including *Peridinium* sp. and *Ceratium* sp. from the Enoggera Reservoir, and an *Actinosphaerium* found in abundance amongst wet moss on the cliffs near the sea-shore at Caloundra.

Mr. H. A. Longman exhibited a live specimen of *Dipsadomorphus fuscus*, Gray, the brown tree snake, captured at Toowong.

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## Proceedings of Forestry Section.

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### AUSTRALIAN FOREST LEAGUE.

A conference of representatives of the various branches of the League was held in the Town Hall, Melbourne, on October 29th last, His Excellency Sir Ronald Munro-Ferguson presiding.

The Queensland Section was represented by Hon. L. E. Groom and Mr. Stumm, Federal members for the Darling Downs and Lilley electorates. Messrs. Maughan and Turley were also asked to act as representatives, but they were unable to be present.

It was moved by Professor Watt (Sydney), "that this meeting approves of the formation of a national organization to be called The Australian Forest League."

Mr. Groom in seconding referred to the rapid disappearance of our soft timbers, and to the greatly increased import of pine, when with conservation we might have supplied all our wants for years to come.

The following officers were elected:—Patron, Sir Ronald Munro-Ferguson; Federal President, Sir Frank Madden; Secretary, Dr. Harvey Sutton.

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## Abstract of Proceedings of Geology Section.

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MEETING, JUNE 4th, 1914.

A meeting was held on Thursday, June 4th, with the object of forming a Geology Section of the Royal Society of Queensland. The following were present: Messrs. L. C. Ball, W. H. Bryan, B. Dunstan, H. C. Richards, E. C. Saint-Smith and A. B. Walkom.

Office bearers were elected as follows:—President B. Dunstan, F.G.S.; Vice-President, H. C. Richards, M.Sc., Hon. Secretary, A. B. Walkom, B.Sc.

It was carried, "that the aim of the Section be primarily for the general discussion of geological matters, both academic and economic, pertaining particularly to Australia; the discussion of current literature in Geology, and the exhibition of specimens of particular interest to members of the Section."

The order of business at meetings was decided on as follows:—

1. Minutes.
2. Correspondence.
3. Current literature
4. Exhibits.
5. Discussion.
6. General.

MEETING, JUNE 30th, 1914.

Mr. Dunstan in the chair.

Eight members and one visitor present.

Mr. Dunstan exhibited specimens of a siliceous sponge (*Purisiphonia clarkei*) from the Rolling Downs Formation, near Roma.

A discussion followed, the subject being the intake beds of the Australian Artesian Water Basin. Messrs. Saint-Smith, Dunstan, Richards, Thom, and Walkom, and Dr. Shirley, took part in the discussion.

The discussion tended to show that the main intake beds are freshwater sandstones containing fossil plant remains indicating a Trias-Jura age. These beds lie conformably below the Rolling Downs Formation, which contain plentiful remains of marine shells.

It was pointed out by Mr. Saint-Smith that in the country to the N.E. and E. of Roma, the desert sandstone formation is non-existent, and that areas previously mapped as Desert Sandstone are occupied by beds of either the Trias-Jura System or Rolling Downs Formation. It was also pointed out that the so-called Blythesdale Braystone as mapped is made up partly of porous sandstone of Trias-Jura age, and partly of impervious calcareous beds of the Rolling Downs Formation.

The most important point brought out by the discussion was the fact that the intake beds occupy a much greater area than was formerly supposed, including, as they now do, a large area of rocks of Trias-Jura age.

#### MEETING, JULY 30TH, 1914.

Mr. Dunstan in the chair.

Ten members were present.

Mr. Dunstan exhibited specimens of fossil cephalopods from Western Queensland, including *Nautilus*, *Ammonites*, *Criocerat* and *Belemnites*.

Mr. Richards exhibited a specimen of galena showing twinning.

A discussion took place on the possibility of obtaining oil at Roma. Mr. Cameron opened the discussion, outlining the history of the boring operations at Roma. Messrs. Connah, Dunstan, Richards, Saint-Smith, and Walkom took part in the discussion.

#### MEETING, OCTOBER 1st, 1914.

Mr. Dunstan in the chair.

Seven members and one visitor were present.

Mr. Blake exhibited a specimen of Emperor Penguin.

A discussion took place on "Recent developments in the Burrum Coalfield." Mr. Dunstan outlined the work done on the Burrum field, showing the relations existing between

the coal measures and marine beds. Messrs. Richards, Cameron, Ball, and Walkom, and Dr. Shirley contributed to the discussion.

MEETING, NOVEMBER 12TH, 1914.

Mr. Dunstan in the chair.

Seven members were present.

After some discussion it was decided that the subject for the next meeting, to be held about the end of March, 1915, should be "The Oxley Beds."

A discussion took place on "Rock Classification." Mr. Richards introduced the subject, and gave a summary of the various systems of rock classification.

Messrs. Ball and Dunstan, and Dr. Shirley took part in the discussion.

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## Proceedings of Biology Section.

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MEETING, SEPTEMBER 8TH, 1914.

Dr. J. Shirley in the chair.

Six members present.

Dr. Shirley exhibited specimens of the "Grey Gum" of Queensland, and pointed out that the Queensland Grey Gum, though usually set down as *E. saligna* does not agree with the description of the species given in Müller's Eucalypts of Australia. It is probable that the tree referred to by Queensland botanists as *E. botryoides*. Smith, is the true *E. saligna*. Among the specimens supplied to Dr. Shirley as examples of Grey Gum, from various parts of Queensland were:—*E. melliodora*, *E. baueriana*, and *E. propinqua*.

Most of those present took part in a discussion of the fruits, leaves, etc., Mr. Smith pointing out the relation existing between the type of venation and the kind of products obtained from Eucalyptus leaves.

MEETING, OCTOBER 13TH, 1914.

Dr. J. Shirley in the chair.

Three members and one visitor present.

Dr. Shirley exhibited specimens of several different species of Chitons, a group belonging to the class Amphineura of the Mollusca. He then gave a short description of their distribution and general anatomy, illustrated by reference to the specimens.

The chairman pointed out that the group is not a typical Molluscan one, especially in regard to its nervous system, which is simple. Some discussion ensued as to whether this signified a primitive or a degenerate form, Dr. Shirley inclining to the former view.

MEETING, NOVEMBER 10TH, 1914.

Dr. J. Shirley in the chair.

Five members present.

Mr. W. R. Colledge exhibited some slides and micro-photographs of a family of flies, Simuliidæ. He pointed out that this family is distributed all over the world, but its representatives are not very numerous in Australia. In Europe and America they are injurious to stock. A short description of their life-history and general appearance was given by Mr. Colledge, with reference to the photos and slides.

Dr. Shirley referred to the investigations lately being made in regard to one of the species of *Simulium* as a carrier of a disease of the scalp, prevalent in Italy and Roumania.

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## List of Societies and Institutions with which the Royal Society of Queensland exchanges Publications.

### AFRICA.

#### SOUTH AFRICA.

Geological Commission, Cape of  
Good Hope  
Natal Museum.

### AMERICA.

#### CANADA.

Canadian Institute.  
Hamilton Association.  
Literary and Historical Society,  
Quebec.  
Nova Scotia Institute of Natural  
Science.  
Royal Astronomical Society of  
Canada.  
Royal Society of Canada.

#### MEXICO.

Instituto Geologico de Mexico  
Meteorologico Observatorio.  
Societa Cientifica, Mexico.

#### UNITED STATES.

Academy of Natural Sciences,  
Philadelphia.  
Academy of Science, Rochester,  
N.Y.  
Academy of Science, Wisconsin.  
American Academy of Arts and  
Sciences, Boston.  
American Geographical Society,  
N.Y.  
American Mathematical Society,  
N.Y.  
American Museum of Natural  
History, N.Y.  
American Philosophical Society,  
Philadelphia.

#### UNITED STATES—*Continued.*

Boston Society of Natural History.  
Californian Academy of Science.  
Carnegie Institute.  
Colorado State College.  
Dept. of Agriculture, Washington,  
D.C.  
Dept. of Commerce and Labour,  
Washington, D.C.  
Field Museum of Natural History,  
Chicago.  
Geographical Society of Phila-  
delphia.  
Geological and Natural History  
Society of Minnesota.  
Geological Survey of California.  
Geological Survey of U.S.A.,  
Washington, D.C.  
Illinois State Laboratory.  
Indiana Academy of Science.  
Kansas Academy of Science.  
Lloyd Library, Cincinnati.  
Massachusetts General Hospital.  
Minnesota Academy of Natural  
Science.  
Missouri Botanic Gardens, St.  
Louis.  
New York Academy of Sciences.  
Smithsonian Institution, Washing-  
ton, D.C.  
University of California, Berkeley.  
University of Kansas.  
University of Minnesota.  
University of Montana.  
University of New York.  
Wilson Ornithological Club.

#### URUGUAY.

Instituto de Pesca, Monte Video.  
Museo Nacional, Monte Video.

## ASIA.

## CEYLON.

Colombo Museum.

## INDIA.

Agriculture Institute. Pusa, Bengal.

Asiatic Society of Bengal.

Board of Scientific Advice for India.

Director General, Indian Medical Service ("Paludism.")

Geological Survey of India.

Superintendent of Govt. Printing, Calcutta.

## JAVA.

Chef van het Mijnesen.

(see also under Holland).

## PHILIPPINE ISLANDS.

Bureau of Science, Manila.

Manila Medical Society.

## AUSTRALASIA.

## NEW SOUTH WALES.

Australasian Association for the Advancement of Science.

Australian Museum, Sydney.

Botanic Gardens, Sydney.

Department of Agriculture.

Department of Mines.

Field Naturalists' Club.

Linnean Society of N.S.W.

Public Library, Sydney.

Royal Anthropological Society.

Royal Society of N.S.W.

Technological Museum, Sydney.

The University of Sydney.

## NEW ZEALAND.

Auckland Institute.

Colonial Museum, Wellington.

Geological Survey.

New Zealand Institute.

## QUEENSLAND.

Colonial Botanist, Brisbane.

Department of Mines.

Field Naturalists' Club.

Public Library, Brisbane.

The Queensland Museum, Brisbane.

The University of Queensland, Brisbane.

## SOUTH AUSTRALIA.

Department of Mines.

National Museum, Adelaide.

Royal Geographical Society.

Royal Society of S.A.

The University of Adelaide.

## TASMANIA.

Field Naturalists' Club.

Royal Society of Tasmania.

The University of Tasmania.

## VICTORIA.

Australian Institute of Mining Engineers.

Australian Ornithologists' Union.

Department of Agriculture.

Dept. of Fisheries (Commonwealth).

Department of Mines.

Field Naturalists' Society of Victoria.

Government Botanist, Melbourne.

National Museum, Melbourne.

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Royal Geographical Society.

Royal Society of Victoria.

The University of Melbourne.

## WESTERN AUSTRALIA.

Department of Mines.

Museum, Perth.

Royal Society of W.A. (late Natural History Society).

The University of W.A.

W.A. Astronomical Society.

## EUROPE.

## AUSTRIA.

Astronomische Arbeiten, Vienna.

K.K. Geographische Gesellschaft.

K.K. Gradmessige Bureau.

## BELGIUM.

Academie Royale de Belgique.

Jardin Botanique de l'Etat, Brussels.

Société Royale de Botanique de Belgique.

Solvay Institute of Sociology, Brussels.

## ENGLAND.

British Museum.  
 Cambridge Philosophical Society.  
 Conchological Society.  
 Imperial Institute.  
 Linnean Society of London.  
 Philosophical and Literary Society,  
 Leeds.  
 Philosophical and Literary Society,  
 Manchester.  
 Royal Botanic Gardens, Kew.  
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## FRANCE.

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 Museum de Histoire naturelle,  
 Paris.  
 Société des Sciences naturelles,  
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## GERMANY.

Naturforschende Gesellschaft,  
 Frankfurt-am-Main.  
 Naturhistorischer Verein der  
 Preussischen Rheinland and  
 Westfalens, Bonn.  
 Verein für Naturkunde zu Cassel.

## HOLLAND.

Koninklyke Naturkundige  
 Vereeniging in Nederlandsch.  
 (See also under Java).

## HUNGARY.

Naturwissenschaftliche Verein de  
 Komitatus, Trencsin.

## IRELAND.

Royal Irish Academy.

## ITALY.

Academia Real della Scienza della  
 Instituto Bologna.

## ITALY—Continued.

Laboratorio di Zoologia Generale  
 di Agraria.  
 Museo Civico di Storia Naturale,  
 Genoa.  
 Rassegna Mensile di Botanica  
 ("Malpighia"), Catania.  
 Società Africana d'Italiana, Naples.  
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## PORTUGAL.

Academia Polytechnica Porto  
 (Oporto).

## RUSSIA.

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 Petrograd.  
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## SPAIN.

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## SWEDEN.

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## SWITZERLAND.

Naturforschende Gesellschaft, Basel.  
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PROCEEDINGS  
OF THE  
ROYAL SOCIETY  
OF  
QUEENSLAND  
FOR 1915

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VOL. XXVII.—PART I.

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— Edited by —  
A B WALKOM B.Sc

*The Authors of Papers are alone responsible for the statements made and  
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# A REVIEW OF RECENT AUSTRALIAN CONCHOLOGY.

(PRESIDENTIAL ADDRESS.)

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BY JOHN SHIRLEY, D.Sc., F.M.S.,

Principal, Teachers' Training College, Brisbane.

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*(Delivered before the Royal Society of Queensland, March  
29th, 1915.)*

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THE conchologists of the world owe a debt of gratitude to America for the production of a standard work on the Mollusca. The publication of Tryon's Manual of the Mollusca has placed our knowledge of the Gasteropoda, Amphineura and Scaphopoda on a sound basis. The specialist, who devotes himself to the determination of species in these classes, has this work continually at his elbow, and though he may find fault with a few minor details, it is to him what the dictionary is to the beginner in a new language. Recent species makers with Tryon's Manual for reference are apt to talk from a height about "Tryon who hastily united species, which, though then indefinite in literature were distinct in nature," or of the slovenly work of early authors, as for instance the "carelessness and incapacity of Lovell Reeve," or to complain that "having left his species in the wrong genus, unfigured, unlocalised, known and knowable only to those who saw the type, Arthur Adams fortunately crowned his work by the adoption of a preoccupied name." Of the known marine mollusca of Queensland, it must not be forgotten

that we owe the recognition and description of one-sixth of its species to Reeve, and one-twelfth to A. Adams, either alone or in conjunction with H. Adams, Reeve or Angas. This criticism of the private worker by men who have the resources of a State at their back is unfair and ungenerous; and leads one to recall with amusement the not yet forgotten early blunders of the critics themselves.

The Second Series of the Manual of Conchology has reached its twenty-second volume and its completion will place the classification of the land-shells — Subclass Pulmonata—on a similarly sound footing. The late Geo. W. Tryon, Junr., in a preface dated January 1st, 1885, makes the following declaration as to his basis of classification—"The classification of the 'Pulmonata' will be essentially that exhibited in the third volume of my 'Structural and Systematic Conchology'; modified, nevertheless, as to minor details and chiefly by the introduction of additional groups. In the arrangement and synonymy of the species, the late Dr. Louis Pfeiffer's 'Nomenclator Heliceorum Viventium,' 1878, will be my principal guide, and I will endeavour so to intercalate the more recently described species as to preserve the essential features of that monumental work. I shall not follow him blindly, however. I shall consider the opinions of the special students of each local fauna as entitled to great weight, and I shall constantly subject questions of synonymy to the test of comparison of specimens in the admirable collections of terrestrial shells in the Museum of the Academy of Natural Sciences of Philadelphia."

Mr Tryon lived to complete four volumes, the first dealing with the Testacellidæ, etc., the second with the Zonitidæ, and the third and fourth with various orders of the Helicidæ, when death put an end to his labours.

Fortunately in February, 1888, a fit successor to continue this important work, was found in Mr. Henry A. Pilsbry, Conservator of the Conchological Section of the Academy of Natural Sciences of Philadelphia. Mr. Pilsbry completed the Helicidæ in Volume IX., and took this opportunity to make an index and a revision of all orders and sub-classes described by his predecessor. Twenty-

two volumes dealing with inoperculate land shells have been published to date. The following table gives a brief summary of their contents and shows where the indexes are to be found:—

| Descriptions<br>Volume. | Family.  | Index<br>Volume. |
|-------------------------|--|------------------|
| I                       | Testacellidæ to Arionidæ .. ..   | I                |
| II                      | Zonitidæ, Endodontidæ ( <i>Laoma</i> , <i>Flammulina</i> , <i>Endodonta</i> , <i>Pyramidula</i> ) .. | IX               |
| III-IX                  | Helicidæ, Acavidæ ( <i>Strophocheilus</i> , <i>Gonyostomus</i> ) .. ..                               | IX               |
| X-XIV                   | Bulimulidæ, Cerionidæ .. ..  | XIV              |
| XV-XVI                  | Urocoptidæ, Megaspiridæ .. ..  | XVI              |
| XVI-XX                  | Achatinidæ, Oleacinidæ, and Ferrusacidæ  | XX               |
| XXI                     | Partulidæ .. ..  | XXI              |
| XXI-XXII                | Achatinellidæ .. ..  | XXII             |

This system of classification is now generally accepted and was used by Mr. Charles Hedley and Mr. W. F. Petterd in their valuable "Revised Census of the Terrestrial Mollusca of Tasmania." It will be necessary to bring the collections of land shells in our museums into agreement with Pilsbry's classification if they are to be of any service to students and collectors.

It is understood that the Manual is not to be extended to include the Pelecypoda. This is a distinct loss to science and to the species makers, whose timidity in dealing with bivalves contrasts with the readiness with which they attack material where the main divisions have been dealt with by Tryon or Pilsbry.

The loss of the trawler Endeavour will also be a loss to scientific study in Australia. Material collected by the trawler was distributed to various workers of eminence in the field of science, the Mollusca being reported upon by Mr. Charles Hedley, Assistant Curator and Conchologist, Australian Museum, Sydney. Mr. Hedley took part in

one cruise from Melbourne to Nuyt's Archipelago, W. Australia, when he obtained specimens of some three hundred and fifty species, the greatest haul being made in the neighbourhood of Cape Wiles, South Australia. In his report on the Mollusca obtained by the F.I.S. "Endeavour," chiefly off Cape Wiles, South Australia, the writer gives a list of Adelaidean species, and describes a number of new shells. The most important feature of the paper is a separation under Carpenter's title—*Amphithalamus*—of a section of the swollen genus *Rissoa*. The Australian species and their synonyms are given for the benefit of systematists generally. In Part II. of the same series, Sydney, 2nd February, 1914, a number of large shells taken in the Australian Bight are described, some being new species, and various changes in classification are indicated.

One of the most important of recent additions to Australian Conchology is Mr. Hedley's "Notes in Museums Abroad" forming Part XI. of "Studies of Australian Mollusca." In conjunction with Mr. E. A. Smith, the Conchologist of the Natural History Museum, South Kensington, the writer examined many critical and doubtful species, each of which is discussed at length, and notes on their localities, synonyms, etc., are given. Much of this information was supplied by the learned British conchologist, his opportunities in charge of the South Kensington collection having made him one of the arbiters in molluscan determination.

Mr. Hedley also visited Newcastle, England, to study G. F. Angas's Australian land-shells, and Geneva, where Lamarck's priceless collection is housed in the city museum. Of this collection the well known conchologists Kiener and Chenu were in turn curators. The result of Mr. Hedley's critical studies is the relegation to the position of synonyms of many names that have swollen Australian lists, and recommendations that some twenty-four species be struck off as incorrect recognitions, or because they have never been figured, or from the habitat proving to be outside Australian waters, etc., Objection has already been given\*

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\* Shirley, Proc. Roy. Soc. Q., 1914, XXVI., 48.

to the elimination of *Arca pistachia*, Lamk., from Queensland shells, and a further objection may be made to striking *Thalotia tricingulata*, A. Ad., off our lists. This shell is found plentifully at Murray Island, and extends at least as far south as Gladstone. It agrees far too closely with *Monodonta diminuta*\* Hedley, which is likely to prove a synonym.

Mr. Hedley's "Studies of Australian Mollusca," Part XII., contains much important matter for the collector and systematist. There is a rearrangement of the former overweighted genus *Voluta* giving generic rank to a number of its subdivisions, and rearranging under these all known Australian species. The beautiful shell, *Scaphella reticulata*, Rve., disappears from the Queensland list, Mr. Tom Iredale proving that this name had already been used, and renaming it *S. hedleyi*. A very appreciative article on the French conchologist Montrouzier is introduced in connection with a generic name given in his honour by Souverbie which lapses, having been previously appropriated in entomology.

In the examination of protean forms of *Acmaea* and *Helcioniscus* pertinacity and keen research are exhibited, and many tangled skeins are straightened for the assistance of the student. To those who have similar work to do in other branches of biology, a study of the argument upon the many-named *Patella tramoserica*, Chemnitz, will be of service.

All descriptions are detailed enough to aid recognition, without being so minute as to be true of the type specimen only; and the plates, as is always the case in Mr. Hedley's papers, are models of their kind. A large proportion of the new species are additions to the Queensland fauna.

Mr. Tom Iredale, the authority on Chitons, paid a visit to Queensland during the meeting of the Australasian Association in Brisbane, 1909. He collected round Caloundra, at the northern end of Moreton Bay, where he obtained fifteen species, of which ten had not previously

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\* Hedley, Rec. Aust. Mus., VIII, I., p. 137, Pl. XLI, f. 12.

been recorded for our State. In all, Mr. Iredale collected ninety-five species of Australian Polyplacophora. At his request, to assist him in his studies, specimens of Chitons in my collection were sent to him, in all forty-six species or marked varieties, of which the majority have been returned, while some are still under consideration. Kindly recognition of the assistance given was made through the Proceedings of the Malacological Society.\*

In a paper in Proc. Zool. Soc.,† Mr. Iredale deals with a small collection of shells from the Montebello Islands, W.A. As the Dampierian province stretches from Cape York along the northern and western portions of Australia to Shark Bay, it is not surprising that a number of the species identified are found in the Gulf of Carpentaria, and much helpful work has been done in collating the synonyms of well known species.

The late Mr. A. J. Jukes-Browne, F.R.S., F.G.S., a writer both on fossil and on recent shells, was specially interested in Pelecypoda, and wrote a series of articles in the proceedings of the Malacological Journal of which Part II. appeared in Volume XI., Part II., June, 1914. To this conchologist were forwarded specimens of all collected species of the *Venus* family. Review of the shells forwarded proved more conclusively than ever the great want of a standard work on bivalves; it also revealed the overlapping of species, the distribution of shells under incorrect names, and the simultaneous use of several synonyms for one and the same shell. Mr. Jukes-Browne was specially interested in *Cytherea embrithes*, Melville and Standen, whose astonishing similarity to the Madeiran *Cytherea* (*Antigona*) *effossa*, Phil, was shown on receipt of a specimen from my correspondent. Through a relative the sad news has just come to hand of Mr. Jukes-Browne's death, after much suffering, which did not keep him from carrying on his beloved studies to the last. His collection has been left to Oxford University. His death, as his labours were beginning to evolve order out of the chaos of bivalve nomenclature and classification, will be a distinct loss to all students of this branch of natural history.

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\* Loc. cit., Vol. XI, Pt. 2, p. 131.

† 1914, Pt. 3, p. 665.

Mr. H. H. Bloomer, well known for his anatomical studies of shell-fish, especially the genus *Silqua* and its allies, made a collection of marine shells during a visit to Queensland in 1912. He submitted a small collection of Moreton Bay bivalves to Mr. E. A. Smith. These were chiefly Mactridæ, and were dealt with by the conchologist of the British Museum in the Proceedings of the Malacological Society.\* The paper, by its table of synonymy, sheds much long-needed light on species reported from Queensland; it makes a new species, *M. queenslandica*, of a shell formerly distributed under various names, and common in Moreton Bay. It also determines a common, dirty-brown *Mactra*, to be picked up anywhere on the beach at Caloundra, as *M. tristis*, Desh. This paper still further accentuates the need for the continuation of Tryon's Manual to include the Pelecypoda.

As in other groups of animals the teeth of mollusks are of assistance in the grouping of genera and the classification of species. In the volume on "Molluscs and Brachiopods" of the Cambridge Natural History Series, the figures of radulæ or lingual ribbons, are all taken from original specimens in the collection of the Revd. Professor H. M. Gwatkin, D.D., M.A. At the request of the Professor a number of Queensland shells, each containing the animal and preserved in spirit, were forwarded to him, and he very kindly returned a large number of mounted radulæ, of which many were Australian. These, when viewed under the microscope, are among the most beautiful objects in nature.

In a presidential address of October 11th, 1914, entitled "Some Molluscan Radulæ" published in the "Journal of Conchology" the value of a study of this branch of anatomy is strikingly shown. Professor Gwatkin states: "The distribution of *Physa* is anomalous. Like the higher mammalia, it has not reached Australia and Polynesia—at least all the *Physas* I have seen from those parts have the radula of *Isidora* (including *Physopsis*). Nevertheless there is a true *Physa* (*Physa compacta*, Gld.) from the Hawaiian Islands. Either we have overlooked *Physas*

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\* Loc. cit., Vol. XI., Pt. 2, pp. 137-151.

in Australia, or—what I am more inclined to think—this *Physa*, like some of the birds, may be of American origin.” Yet Mr. E. A. Smith in a paper read before the Linnean Society of New South Wales, April 21st, 1881, gives the names of fifty-two species of Australian *Physas* and one of *Physopsis*.

Mr. H. B. Preston, F.L.S., is one of the best known writers on land-shells. He has published papers on the Pulmonata from all parts of the world, including recent ones on Chinese, Nigerian, British East African, South African, and Uruguayan shells. To Australian conchology his study of shells from the Montebello Islands, West Australia, is a valuable addition. Several parcels of Queensland mollusca have been sent to Mr. Preston, among which were a few new species.

For a record of Victorian marine mollusca, and for the determination of many new species, we are indebted during recent years mainly to Mr. J. H. Gatliff, at first in conjunction with Mr. G. B. Pritchard, but for the last seven years in collaboration with Mr. C. J. Gabriel. Over one thousand marine species have been recorded from Victorian waters. An index of seven hundred and sixty-five species was given in the Proceedings of the Royal Society of Victoria, in 1905,\* and between two and three hundred additions have since been announced. In illustration of new species, Mr. Gatliff and his colleagues have at times made use of photographs of large shells taken on a black background. These are particularly clear and definite, and, where the copies are struck off distinctly, are of more use to collectors and workers generally than a drawing. This will be readily acknowledged by any expert studying such an illustration as Plate XV., of Proc. Roy. Soc., Victoria, 1903.

South Australian conchologists have been assisted in their studies by the labours of Dr. J. C. Verco, who published a list of nine hundred and sixty Adelaidean species, in 1908, to supersede the out of date and out of print list published by Adcock in 1893. For over twenty years Dr. Verco has devoted himself to this branch of biology, and has now one

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\* Proc. Roy. Soc., Vic., 18 (N.S.), Pt. II., pp. 70-92.

of the finest private collections in Australia. It may interest members of this Society to know that the late Mr. G. Gross's collection passed into Dr. Verco's hands, and arrangements have been made which will prevent this valuable collection of Australian shells from being broken up. Recently Dr. Verco has extended his studies to the great Australian Bight and Western Australia generally, and in the "Transactions of the Royal Society of South Australia" for 1912,\* gives a list of one hundred and fifty shells mainly from Geraldton and the Abrolhos Islands.

The Polyplacophora of Dr. Verco's list were furnished by Dr. W. G. Torr, also of South Australia, who has made this difficult family his special study. Dr. Torr has collected in most of the Australian States, and alone, or in collaboration with Mr. W. L. May and others, has published critical notes and descriptions of new species which have been of marked assistance, especially to southern workers.

Tasmania has been noted for its many workers and collectors in the conchological field, of whom Petterd, Legrand, Simson, Beddome, Miss M. Lodder, the Revd. Tenison-Woods, may be mentioned. The "Census" of Tasmanian Shells of the latter, published in 1878† was revised in the Proceedings of the Linnean Society of New South Wales, 1901,‡ by Professor Ralph Tate and Mr. W. L. May; since which date Mr. May has communicated many papers on the molluscan fauna of the island, mainly by means of the publications of its Royal Society. Other of Mr. May's papers, in conjunction with Dr. Torr or with Mr. C. Hedley, appear in the same series or in the "Records of the Australian Museum." Mr. May has done much to clear the way for those who follow him in the study of Tasmanian shells, by ridding the list of false entries, by his extensive lists of synonyms, by his study of critical species, and by constant reference to typical specimens, especially to those in the collections of the Tasmanian Museum.

The geological distribution of marine shellfish is receiving increased attention since the bulk of existing species have been determined and recorded.

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\* Loc. cit., Vol. XXXVI, pp. 202-205.

† Proc. Roy. Soc., Tas., pp. 26-57 1877.

‡ P.L.S., N.S.W., 1901, Pt. 3, July 31st, pp. 344-471, Pl. XXXIII-XXXVII.

Our coasts have been divided into four sub-regions—  
(1) The Solanderian, from Cape York to Moreton Bay ;  
(2) The Dampierian, from Cape York to Shark Bay ; (3) The Adelaidean, from Shark Bay to the Australian Bight along the south coast of Australia, to Wilson's Promontory, and including the west side of Tasmania ; (4) The Peronian, taking in the east side of Tasmania, Victoria and New South Wales, to Moreton Bay. The first and second of these are subdivisions of the great Indo-Pacific Province, and the third and fourth of the Australian Province. Shells have been assigned to each of the four subprovinces, not always in a tentative way, but from the point of view of the courtiers of King Canute, the creatures being expected to obey the arrangement made for them, however artificial or temporary.

Some few years ago specimens of a striking species of *Littorina* were sent down from Yeppoon, and were submitted to a specialist for determination. He decided that they belonged to an American species from the North Atlantic, and that they could not have come from Keppel Bay. Recently Dr. Hamlyn-Harris visited Dunk Island and picked up a single specimen of the same *Littorina* on the island beach. While such mistakes are possible, it is well to make our schemes of distribution elastic, until the gaps in our information have been filled in.

My main purpose in placing this information before the Royal Society of Queensland is to show how little is being done for Queensland conchology within the State, and to point out to possible workers what a wide field and what splendid opportunities lie waiting for them. With the opening of the Queensland University new workers in biology are being added to our present meagre list, and the known species of marine mollusca, numbering close on two thousand five hundred at present, should in the next few decades be raised to three or four thousand. Of known species little has been recorded about the animals themselves, and large stores of material await the coming of the anatomist, the physiologist and the student of life histories.

# STUDIES IN AUSTRALIAN LEPIDOPTERA.

BY A. JEFFERIS TURNER, M.D., F.E.S.

(Read before the Royal Society of Queensland, 26th April, 1915.)

Family ARCTIADÆ.

Subfamily Nolinæ.

PISARA HYALOSPILA.

*υαλοσπιλος*, with transparent spot.

*Pisara hyalospila*, Hmps. Cat. Lep. Phal., Suppl. i., p. 389.

♂ ♀ 18-20 mm. Head white. Palpi 3; pale brownish. Antennæ grey; basal joint white; ciliations in ♂ 2. Thorax brown mixed with whitish. Abdomen whitish; a strong basal dorsal crest pale brown. Legs whitish with some fuscous irroration; anterior femora and tibiæ fuscous; anterior and middle tarsi fuscous with white annulations. Forewings suboblong, costa rather strongly arched, apex rounded, termen obliquely rounded; in ♂ with a square hyaline fovea at  $\frac{1}{3}$  with transversely striated base and visible on both upper and lower surfaces; white; basal third fuscous brown with a darker outwardly curved transverse line from  $\frac{1}{3}$  costa to  $\frac{1}{4}$  dorsum; fovea preceded and followed by a raised tuft of scales; a fine interrupted dark fuscous line from  $\frac{3}{4}$  costa to mid-dorsum, curved outwards in disc; a thick dark fuscous line from costa before apex to tornus, straight but with a posterior dentation above tornus; a fuscous terminal line; cilia white with some fuscous irroration. Hindwings with termen rounded grey-whitish, towards base whitish; cilia whitish.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in June and October.

Q Brisbane. Three specimens.

## CELAMA THYRIDOTA.

*θυριδοτος*, windowed.

*Celama thyridota*, Hmps. Cat. Lep. Phal., Suppl. i., p. 390.

14-16 mm. Head white. Palpi  $2\frac{1}{2}$ ; white external surface suffused with pale fuscous. Antennæ white; in ♂ finely pectinated. Thorax white with some pale fuscous suffusion. Abdomen grey-whitish, apices of segments white. Legs white, with some fuscous irroration; tarsi fuscous annulated with white. Forewings triangular, costa nearly straight to beyond middle, then rather abruptly bowed, apex rounded, termen obliquely rounded; in ♂ with a large oval hyaline fovea in costal and posterior part of cell, and a second narrower similar fovea between bases of veins 6 and 7; white with some fuscous and brownish irroration; three raised tufts on costa, fuscous-brownish; first near base; second at  $\frac{1}{4}$ , its apex rounded, expanded, dark-fuscous, preceding first fovea; third shorter, its rounded apex lying between the two foveæ; a dark-fuscous dot beneath second tuft; a fine dark fuscous transverse line at  $\frac{3}{4}$ , with slight outward projections in middle and above dorsum; an irregularly dentate pale fuscous subterminal line, with subcostal and median projections; an interrupted pale fuscous terminal line; cilia white with greyish specks. Hindwings with termen rounded; grey-whitish; cilia grey-whitish.

Exactly like *C. bifascialis*, Wlk., which is found in the same localities, except for the ♂ foveæ. The only difference I can detect in the ♀ is in the shape of the forewings, but this may not be trustworthy.

Type in Coll. Turner.

N.Q., Townsville, in May (♂ type); Q., Brisbane (1 ♀).

## NOLA LECHRIOPA.

*λεχωπος*, oblique-looking.

*Nola lechriopa*, Hmps. Cat. Lep. Phal., Suppl. i., p. 418; Pl. 24, f. 10.

♂ ♀ 16-18 mm. Head white, irrorated with grey. Palpi 3; grey. Antennæ grey-whitish; in ♂ with

moderately long ciliations (2). Thorax grey, with slight fuscous irroration. Abdomen pale grey. Legs whitish, with fuscous irroration; anterior pair fuscous; all tarsi fuscous with whitish annulations. Forewings elongate-triangular, costa moderately arched, more strongly towards apex, apex rounded, termen obliquely rounded; grey, with slight fuscous and whitish irroration: three small tufts of raised scales beneath costa, near base, at  $\frac{2}{5}$ , and middle, fuscous; a slender fuscous line, internally oblique, from second tuft, bent outwards and dentate near dorsum, ending on  $\frac{1}{3}$  dorsum; a dark fuscous finely dentate line from  $\frac{2}{5}$  costa, at first outwards, then strongly sinuate and very obliquely inwards, bent outwards again beneath middle of disc and ending on dorsum at  $\frac{2}{5}$ , its posterior edge suffusedly grey-whitish; a faintly darker dentate subterminal line; also edged posteriorly with grey-whitish; some obscure dark terminal dots; cilia grey, with whitish specks. Hindwings rather elongate, termen gently rounded; pale grey; cilia pale grey.

Type in Coll. Turner.

Q., Brisbane, in July and September; Stradbroke Island, in September; four specimens.

#### NOLA ZAPLETHES.

*ζαπληθης*, of full size.

*Nola zaplethes*, Hmps. Cat. Lep. Phal, Suppl. i., p. 418. Pl. 24; f. 9.

♀ 28 mm. Head white; face irrorated with pale brownish-fuscous. Palpi 2; pale brownish-fuscous, basal joint dark fuscous. Antennæ grey-whitish. Thorax whitish, tegulæ pale brownish-fuscous. Abdomen whitish. Legs whitish; tarsi fuscous, with whitish annulations; anterior coxæ fuscous. Forewings suboblong, costa strongly arched at base, then straight (apex broken), termen obliquely rounded; whitish; a broad pale fuscous streak from base along costa to  $\frac{1}{5}$ ; a dark fuscous ring on costa at  $\frac{2}{5}$ ; a pale fuscous suffusion on costal half of disc containing crests of raised scales at  $\frac{1}{5}$  and middle; a curved dark fuscous line from  $\frac{2}{5}$  costa towards midtermen, then bent parallel to termen

not reaching tornus ; cilia whitish. Hindwings with termen rounded ; grey-whitish ; cilia grey-whitish.

Type (damaged) in Coll. Turner.

Q., Mount Tambourine, in November ; one specimen. The locality given by Hampson is incorrect.

#### NOLA PHLÆOPHILA.

*φλοιοφιλος*, bark-loving.

*Nola phlæophila*, Hmps. Cat. Lep. Phal., Suppl. i., p. 419. Pl. 24 ; f. 11.

♂ ♀ 22-24 mm. Head white, with a few dark fuscous scales. Palpi 3 ; whitish, towards base dark-fuscous, in ♀ mostly dark-fuscous. Antennæ grey-whitish, towards base white ; ciliations in ♂ 2. Abdomen pale fuscous ochreous-tinged ; tuft whitish-ochreous. Legs fuscous ; posterior pair ochreous-whitish. Forewings suboval, costa strongly and uniformly arched, apex round-pointed, termen obliquely rounded ; whitish with fuscous irroration ; markings dark-fuscous ; a short broad streak from base of costa ending in a raised tuft ; a fine line from  $\frac{1}{4}$  costa obliquely outwards to a raised tuft, there sharply angled, again angled outwards, then curved to  $\frac{1}{2}$  dorsum ; a third tuft beneath mid-costa connected by a subcostal streak with second tuft ; a second line from midcosta very obliquely outwards, then curved and continued by interrupted dots to mid-dorsum ; some fine streaks on veins in subterminal area, with some whitish streaks succeeding them, and in ♀ a series of short streaks running into termen ; cilia grey barred with whitish, apices whitish. Hindwings with termen rounded ; grey ; cilia pale grey.

Type in Coll. Turner.

Q., Brisbane, in July and August ; three specimens on tree trunks.

#### NOLA BELOTYPÆ.

*βελοτυπος*, marked with a dart.

*Nola belotypa*, Hmps., Cat. Lep. Phal. Suppl. i., p. 421, Pl. 24, f. 15.

♂ ♀ 21-22 mm. Head white ; in ♀ grey. Palpi 5 ; grey, internal surface whitish. Antennæ pale grey, towards

base whitish; ciliations in ♂ 2 Thorax grey, anteriorly in ♂ white. Abdomen grey-whitish. Legs fuscous; posterior pair whitish. Forewings elongate-triangular, costa gently arched, apex round-pointed, termen obliquely rounded; whitish suffused with pale brownish-fuscous; markings dark-fuscous; a subcostal streak from base of costa to middle, gradually attenuating, with a raised tuft at  $\frac{1}{3}$  of disc and at termination; a very oblique sharply and finely dentate line from  $\frac{3}{4}$  costa to mid-dorsum, succeeded by a whitish shade; cilia grey irrorated with whitish. Hindwings with termen rounded; pale grey, cilia pale grey.

Type in Coll. Turner.

N.S.W., Ebor in January; Mount Victoria, near Katoomba, in February; two specimens. The locality given by Hampson is incorrect.

#### Subfamily Lithosiæ.

#### GRAPHOSIA STENOPEPLA.

*στενοπεπλος*, narrow-robed.

*Graphosia stenopepla*, Hmps., Cat. Lep. Phal. Suppl. i, p. 444, Pl. 25, f. 12.

♂ ♀ 24-26 mm. Head, palpi, and thorax pale ochreous. Antennæ pale-ochreous; in ♂ with short ciliations ( $\frac{1}{3}$ ), and longer bristles (1). Abdomen and legs whitish-ochreous. Forewings narrow-elongate; costa gently arched towards apex, apex rounded-rectangular, termen obliquely rounded; whitish-ochreous irrorated with fuscous, more so towards termen; a fuscous fascia from  $\frac{2}{3}$  costa to mid-dorsum, interrupted beneath costa, its anterior edge straight, posterior edge sharply dentate, in ♀ obsolescent; cilia whitish-ochreous. Hindwings elongate-ovate, termen rounded; whitish-ochreous; cilia whitish-ochreous.

Type in Coll. Turner.

N.Q., Atherton; Q., Mount Tambourine, in November. Two specimens. The locality given by Hampson is incorrect.

## SCOLIACMA XUTHOPIS.

ξουθωπις, tawny.

*Scoliacma xuthopis*, Hmps., Cat. Lep. Phal. Suppl. i, p. 461, Pl. 25, f. 22.

♀ 24 mm. Head, palpi, antennæ, and thorax brownish-ochreous. Abdomen grey, tuft brownish-ochreous. Legs brownish-ochreous. Forewings elongate, posteriorly dilated, costa evenly arched, apex rounded, termen obliquely rounded; brownish-ochreous; a faint interrupted fuscous line from  $\frac{2}{3}$  dorsum towards  $\frac{3}{4}$  costa; cilia brownish-ochreous. Hindwings with termen sinuate beneath apex, then rounded; pale ochreous; cilia pale ochreous.

Type in Coll. Turner.

W.A., Albany, in January. One specimen.

## LEPISTA PULVEREA.

*Pulvereus*, dusty.

*Lepista pulvereae*, Hmps., Cat. Lep. Phal. Suppl. i, p. 462.

♀ 23-24 mm. Head, palpi, and thorax brownish. Antennæ brownish; in ♀ with short ciliations ( $\frac{1}{3}$ ) and longer bristles (1). Abdomen brownish-grey. Legs pale brownish. Forewings narrow-elongate, costa evenly arched, apex rounded, termen obliquely rounded; whitish-ochreous, unevenly irrorated with pale-fuscous, which sometimes forms a streak along fold, and a median streak beyond middle; cilia whitish-ochreous. Hindwings broadly ovate, termen rounded; pale ochreous; cilia pale ochreous.

Type in Coll. Turner.

Q., Burpengary, near Brisbane, in April; Stradbroke Island, in April; Coolangatta, in March; three specimens.

## POLIOSIA ZETESIMA, n. sp.

ζητησιμος, to be searched out.

*Poliosia zatesima* (misprint), Hmps., Cat. Lep. Phal. Suppl. i., p. 463, Pl. 25, f. 26.

♂ 12 mm. Head ochreous-grey-whitish; face grey. Palpi minute; grey. Antennæ ochreous-grey-whitish; in

♂ with moderate ciliations (1) and longer bristles ( $1\frac{1}{2}$ ). Thorax ochreous-grey-whitish. Abdomen ochreous-whitish. Legs grey; posterior pair ochreous-whitish. Forewings narrow, costa moderately and evenly arched, apex rounded, termen obliquely rounded; ochreous-grey-whitish without markings; cilia whitish. Hindwings with termen rounded; ochreous-whitish; cilia whitish.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in October; Evelyn Scrub, near Herberton, in December or January; three specimens.

#### HALONE CORYPHÆA, n. sp.

κορυφαίος, chief.

This is the species described by Mr. Meyrick (P.L.S. N.S.W., 1886, p. 729) as *Mosoda consolatrix*, Ros. This is, however, an erroneous identification, as that name is a synonym of *Halone sobria*, Wlk. In the British Museum the two species have been confused, and most of the localities given by Sir Geo. Hampson (Cat. Lep. Phal. i., p. 279) for *sobria* are erroneous. The present species has a wide distribution.

Q., Warwick. N.S.W., Tenterfield, Glen Innes, Ebor, Bathurst, Mount Kosciusko (4,700ft.). V., Beechworth.

#### HALONE EBÆA.

ἥβαιος, little.

*Halone ebæa*, Hmps., Cat. Lep. Phal. Suppl. i., p. 589, Pl. 31, f. 16.

♂ 10 mm. Head whitish. Palpi rather long (2), very slender; whitish, apex fuscous. Antennæ whitish; in ♂ minutely ciliated. Thorax whitish. Abdomen fuscous, tuft whitish. Legs whitish. Forewings oval, costa strongly and evenly arched, apex rounded, termen obliquely rounded; whitish with a few fuscous scales; markings fuscous, indistinct; a dot on midcosta, a second in mid-disc, a third in fold, and a fourth on mid-dorsum, representing an angulated median line; a fine interrupted line from  $\frac{3}{4}$  costa to  $\frac{5}{8}$  dorsum, angulated outwards in disc; a dot on termen beneath apex, and a second above tornus;

cilia whitish. Hindwings with termen rounded, slightly sinuate beneath apex; pale grey; cilia pale grey.

Type in Coll. Turner. A minute and insignificant species.

N.Q., Kuranda, near Cairns, in February, March and May; Innisfail in November; seven specimens.

#### MACADUMA MICROPTILA.

*μικροπτιλος*, with sharp-pointed wings.

*Macaduma microptila*, Hmps., Cat. Lep. Phal. Suppl. i., p. 580.

♂ 20 mm. Head. palpi, and thorax brown. Antennæ brown, in ♂ moderately ciliated ( $\frac{3}{4}$ ), with longer bristles ( $1\frac{1}{2}$ ). Abdomen grey; basal segment and apical tuft brown. Legs whitish-brown. Forewings irregularly quadrate, costa sinuate, strongly bowed at  $\frac{3}{4}$ , apex acute, produced, termen concave: 7, 8 and 9 stalked; brown, without defined markings; a fuscous dot on midcosta and another slightly beyond; traces of a transverse line from second dot; cilia ochreous-brown. Hindwings with termen rounded, slightly sinuate beneath apex; grey; short brown streaks from base along median and internal veins; cilia grey.

Type in Coll. Turner.

Q., Burpengary, near Brisbane, in April; one specimen.

#### CAPRIMIMA PELOCHROA.

*πηλοχρωος*, clay-coloured.

*Caprimima pelochroa*, Hmps., Cat. Lep. Phal. Suppl. i.; p. 611, Pl. 32, f. 16.

♂ ♀ 15-18 mm. Head, palpi, and thorax brownish-fuscous. Antennæ brownish-fuscous; ciliations in ♂  $1\frac{1}{2}$ . Abdomen brownish-fuscous. Legs brownish-fuscous; posterior pair whitish. Forewings triangular, costa rather strongly and evenly arched, apex rounded, termen obliquely rounded; brownish-fuscous; a fine strongly-dentate fuscous line from  $\frac{1}{3}$  costa to  $\frac{1}{3}$  dorsum, in ♂ sometimes blackish on costa; a second similar but more finely dentate and often

indistinct line from  $\frac{2}{3}$  costa to  $\frac{2}{3}$  dorsum, bent outwards in disc; a similar indistinct subterminal line; cilia brownish-fuscous. Hindwings with termen rounded, slightly sinuate beneath apex; brownish-fuscous; cilia brownish-fuscous.

Type in Coll. Turner.

Q., Brisbane, in May and July; Killarney, in October; three specimens. The locality given by Hampson is incorrect.

#### TRICHOCEROSIA ZEBRINA.

*Trichocerosia zebrina*, Hmps., Cat. Lep. Phal. Suppl. i., p 739, Pl. 38, f. 26.

♂ ♀ 20-25 mm. Head blackish, face orange. Palpi blackish. Antennæ blackish; in ♂ bipectinate to apex, pectinations 6; in ♀ serrate; in both sexes hairy on upper surface of shaft. Thorax blackish, tegulæ orange. Abdomen blackish, apical segments ochreous; towards base beneath ochreous with two pairs of lateral orange spots. Legs blackish; middle joints of posterior tarsi ochreous. Forewings narrowly elongate-ovate, costa moderately arched, apex rounded, termen obliquely rounded; blackish; a transverse orange streak from dorsum near base, not reaching costa; an orange spot above dorsum at  $\frac{1}{4}$ ; a second orange streak from mid-dorsum, in ♀ almost reaching midcosta, in ♂ shorter; an ochreous spot just above tornus, with another above in disc, in ♂ these two spots are absent; cilia blackish. Hindwings elongate-ovate; blackish; an orange sub-basal spot; a larger median spot elongated transversely; cilia blackish.

A brilliant little species very tropical in appearance. It differs from the type in having vein 9 present arising with 8 by a common stalk from 7.

Type in Coll. Lyell.

N.S.W., Lilyvale, Wingham, and Stanwell Park, near Bulli, in March; four specimens.

#### Gen. IONTHAS.

*ιονθας*, with fine hairs.

*Ionthas*, Hmps., Cat. Lep. Phal. Suppl. i., p. 777.

Head, thorax, and abdomen clothed with hairs above and beneath. Tongue absent. Palpi minute, porrect.

Antennæ of ♂ bipectinate to apex, pectinations long. Anterior coxæ hairy. Posterior tibiæ with all spurs present. Wings clothed with fine hairs. Forewings with 2 from  $\frac{2}{3}$ , 3, 4, 5 separately from near angle, 6 from near upper angle, 7, 9 stalked, 8 absent, 10 connate with 9, 11 from  $\frac{2}{3}$ . Hindwings with 3 and 4 connate, 5 approximated at base to 4, 6 and 7 stalked, 8 anastomosing with cell to  $\frac{1}{3}$ .

#### IONTHAS ATARACTA.

*ἀταρακτος*, unperturbed.

*Ionthas ataracta*, Hmps., Cat. Lep. Phal. Suppl. i., p. 777.

♂ 24 mm. Head pale ochreous-yellow. Palpi fuscous. Antennæ fuscous; pectinations in ♂ very long (10). Thorax fuscous; tegulæ pale ochreous-yellow. Abdomen ochreous. Legs fuscous. Forewings elongate-triangular, costa gently arched, apex rounded, termen rounded; oblique; pale fuscous; cilia fuscous-whitish. Hindwings broad, termen rounded; pale ochreous-yellow; a moderate fuscous terminal band, attenuated shortly beneath apex; cilia pale-fuscous.

Type in Coll. Turner.

Q., Warwick, in October; one specimen.

#### Subfam. Arctianæ.

#### RHODOGASTRIA TIMIOLIS, n. sp.

*τιμιολις*, worthy of honour.

♂ ♀ 60-64 mm. Head whitish, with a black dot on crown and another on forehead. Palpi short (1), not nearly reaching vertex; rosy, beneath whitish, apices of joints broadly blackish. Antennæ blackish, towards base rosy; in ♂ with minute almost inappreciable ciliations and short bristles ( $\frac{1}{2}$ ). Thorax whitish with ten black dots, one each on tegulæ and patagia, and a double row of three on thorax. Abdomen rosy; basal segments in ♂ partly whitish-ochreous; a double lateral row of black dots; beneath whitish. Legs ochreous-whitish longitudinally streaked with rosy; tarsi rosy; a black dot on base of anterior coxæ. Forewings elongate-oval, costa strongly arched, apex round-pointed, termen slightly rounded, strongly oblique; whitish, semihyaline; a black dot on base of costa, a second on middle of base, and a third

closely following second; a pale ochreous-fuscos broad transverse bar beyond middle on end of cell; a large similar apical patch; in ♂ whole of basal area to middle and on dorsum to tornus suffused with pale ochreous-fuscos; cilia whitish, in ♂ pale ochreous-fuscos. Hindwings with termen slightly rounded in ♀, more strongly in ♂; in ♀ whitish; in ♂ wholly suffused with pale ochreous-fuscos, with long hairs on basal area, and a darker bar on end of cell; cilia whitish.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns (♀); Townsville in April; three specimens received from Mr. F. P. Dodd. I have also seen a ♀ from N.A., Melville Island. The ♀ from N.Q., Cape York, described by Mr. Meyrick as *astreas*, Drury, is in all probability the same species. The females of the two species are scarcely distinguishable, but the males are very different.

### Fam. NOCTUIDÆ.

#### Subfam. Agrotinæ.

#### CANTHYLIDIA EURHYTHMA, n. sp.

*εὐρύθμος*, well-proportioned.

♀ 25-26 mm. Head ochreous-whitish; face pale ochreous-fuscos. Palpi ochreous-whitish. Antennæ pale ochreous-fuscos. Thorax ochreous-whitish. Abdomen whitish-ochreous, towards base ochreous. Legs ochreous-whitish. Forewings triangular. costa nearly straight, apex rounded, termen bowed, oblique; ochreous-whitish; markings dark-fuscos irrorated with pale-ochreous so as to appear greenish; a broad median band, edged internally by a dentate fuscous line, and including a round whitish median discal spot; a fine dentate line from  $\frac{2}{3}$  costa, extending outwards beneath costa, then bent, and slightly sinuate to  $\frac{2}{3}$  dorsum; a subterminal transverse shade; a terminal series of dark-fuscos dots between veins; cilia grey-whitish. Hindwings with termen rounded; ochreous-whitish; a broad fuscous terminal band; cilia whitish, with a grey sub-basal line.

Type in Coll. Turner.

Q., Gayndah; two specimens received from Dr. Hamilton Kenny.

ARIATHISA SPILOCROSSA, *n. sp.*

σπιλοκροσος, with spotted border.

♂ 26 mm. Head and palpi dark-fuscous. Antennæ dark-fuscous; in ♂ shortly and evenly ciliated ( $\frac{1}{2}$ ). Thorax dark-fuscous with a few whitish scales. Abdomen grey. Legs fuscous mixed with whitish; posterior pair paler; tarsi dark-fuscous annulated with whitish. Forewings elongate-triangular, costa straight, apex rounded, termen scarcely oblique, rounded beneath; dark-fuscous; markings and some scattered scales whitish; a short dentate line from costa near base not reaching dorsum; a dentate line from  $\frac{1}{4}$  costa to  $\frac{1}{3}$  dorsum; orbicular represented by a minute white dot; reniform by a blackish spot, its posterior lower angle produced into a sharp point, edged especially posteriorly by whitish; two sharply dentate lines from beneath reniform to before tornus; a series of dots along apical half of costa and whole of termen; cilia fuscous, apices whitish. Hindwing grey; cilia whitish, towards apex grey.

Type in W.A. Museum.

W.A., Busselton, in October; two specimens.

## Fam. LYMANTRIADÆ.

## Subfam. Lymantrianæ.

## Gen. EUZORA, nov.

εὐζωρος, pure.

Palpi minute, porrect. Antennæ bipectinated in both sexes. Thorax and abdomen not crested. Posterior tibiæ without middle spurs. Forewings with 2 from  $\frac{3}{8}$ , 3 from before angle, 7, 8, 9 stalked, 7 arising before 9, 10 and 11 from cell, no areole. Hindwings with 5 approximated at base to 4, 6 and 7 connate, 8 approximated to cell before middle.

Type *Porthesia collucens*, Luc. This genus is the same as *Caragola*, Moore, Lep. Atk., p. 46 (1879), Hmps., Moths Ind. i., p. 489, but that name is preoccupied (Gray, Pisces, 1851).

## EUZORA COLLUCENS.

*Porthesia collucens*, Luc., P.L.S. N.S.W., 1889, p. 1090.  
N.Q., Atherton. Q., Brisbane.

I formerly identified this species with *clara*, Wlk., Cat. Brit. Mus. xxxii., p. 343, but I note that Sir Geo. Hampson, Moths Ind. i., p. 490, states that in that species the palpi and legs are orange, which is not the case in my example.

## LYMANTRIA ANTENNATA.

*Lymantria antennata*, Wlk., Cat. Brit. Mus., iv., p. 881.

*Lymantria aurora*, Turn., Tr. R.S.S.A., 1902, p. 181 (præocc.)

*Lymantria turneri*, Swin., Tr. E.S., 1903, p. 484.

*Aurora* = *turneri* is merely a varietal form. A series of bred specimens shows great variation in the reddish suffusion of abdomen and hindwings.

*Lymantria maculosa*, Wlk. Cat. Brit. Mus. iv., p. 881, is a synonym of *L. grandis*, Wlk., from Ceylon, and the Australian locality may be taken as erroneous.

## LYMANTRIA NEPHROGRAPHA, n. sp.

νεφρογραφος, kidney-marked.

♂ 62-65 mm. Head white. Palpi blackish. Antennæ fuscous or blackish, pectinations brown. Thorax white. Abdomen white, apices of segments blackish. Legs whitish; tarsi fuscous. Forewings triangular, costa moderately arched, apex round-pointed, termen nearly straight, oblique; grey-whitish; markings blackish or sometimes partly reddish; a basal spot; a spot on costa near base, and another beneath it; a transverse row of four dots at  $\frac{1}{8}$ ; an irregularly dentate line from  $\frac{1}{3}$  costa to  $\frac{1}{3}$  dorsum; a dot on costa before middle; a reniform median pale-centred discal spot; a dentate interrupted line from  $\frac{2}{3}$  costa to  $\frac{2}{3}$  dorsum, bent inwards beneath reniform; a similar subterminal line; a terminal series of dots; cilia whitish, on dots partly blackish. Hindwings subquadrate, obtusely angled on vein 4; fuscous, towards termen grey-whitish; a terminal series of blackish dots of which the two next tornus are transversely elongate; cilia as forewings.

Type in Coll. Turner.

Q., Mount Tambourine; Killarney, in November; two specimens.

LYMANTRIA PELOSPILA, *n. sp.*

*πηλοσπιλος*, clay-spotted.

♂ 38 mm. Head white. Palpi whitish, faintly brownish-tinged. Antennæ ochreous-whitish. Thorax white. Abdomen whitish, towards base ochreous-tinged. Legs whitish. Forewings broadly triangular, costa straight to beyond middle, then strongly arched, apex rounded, termen nearly straight, rounded beneath, slightly oblique; white; a brown subcostal spot near base, and a second beneath it; a straight row of brown dots from  $\frac{1}{2}$  costa to  $\frac{2}{3}$  dorsum; a suffused brownish fascia from  $\frac{2}{3}$  costa bent outwards in disc, and then strongly inwards, then outwards again to  $\frac{4}{5}$  dorsum; a suffused interrupted line from  $\frac{2}{3}$  costa joining fascia; cilia white. Hindwings with termen strongly rounded; white; cilia white. Veins 6 and 7 of hindwings are short-stalked, which is unusual in this genus.

Type in Coll. Turner.

N.T., Port Darwin, in October; one specimen received from Mr. F. P. Dodd.

IMAUUS MARGINEPUNCTATA.

B—Bak., Nov. Zool. 1904, p. 410.

N.Q., Atherton; Kuranda, near Cairns in November, December, and February. Also from New Guinea.

Subfam. Anthelinæ

ANTHELA CHRYSOCROSSA, *n. sp.*

*χρυσοκροσσος*, with golden border.

♂ 38 mm. Head fuscous, back of crown ochreous. Palpi fuscous, beneath ochreous. Antennæ pale ochreous, pectinations fuscous. Thorax fuscous; patagia with a basal ochreous spot. Abdomen densely clothed with very long hairs towards apex; fuscous. Forewings triangular, costa straight nearly to apex, apex rounded, termen strongly rounded, slightly oblique; fuscous, partly suffused with orange-ochreous; markings orange-ochreous; a streak

along costa from base to  $\frac{2}{3}$ ; a small discal spot at  $\frac{1}{4}$ , and another somewhat larger at middle; a fine strongly dentate subterminal line; cilia pale ochreous, bases mixed with fuscous. Hindwings with termen strongly rounded; dark fuscous; an ochreous discal dot at  $\frac{1}{3}$ ; an orange-ochreous narrow terminal band containing a few dark-fuscous scales, its anterior edge dentate; cilia orange-ochreous, apices paler. Underside of forewings ochreous; discal dots faintly outlined and followed by a slight fuscous suffusion; a short fuscous line from costa at  $\frac{3}{4}$ ; an interrupted dentate dark-fuscous subterminal line; a suffused fuscous terminal line not reaching tornus; of hindwings like upperside but with larger discal spot.

Type in Coll. Turner.

N.A., Batchelor, near Stapleton; one specimen received from Mr. G. F. Hill.

*ANTHELA OCHRONEURA*, *n. sp.*

*ὠχρὸνευρος*, pale-nerved.

♂ 38 mm. Head and thorax ochreous-whitish. Palpi brownish-ochreous. Antennæ ochreous-whitish, pectinations brown. Abdomen pale brownish-fuscous; tuft and underside ochreous-whitish. Legs ochreous-whitish; anterior and middle pairs fuscous on anterior surface. Forewings triangular, costa straight, arched towards apex, apex rounded, termen strongly rounded, rather outwardly oblique; pale brownish-fuscous with strongly marked ochreous-whitish lines along veins; comprising a wide subcostal streak bifurcating beyond middle, and reuniting before apex, giving off five streaks to costa, apex and termen; a median streak giving off four streaks to termen; and a subdorsal streak ending in tornus; dorsal edge ochreous-whitish; cilia whitish, bases barred with pale brownish-fuscous. Hindwings with termen strongly rounded; pale brownish-fuscous; veins outlined by slender whitish lines; cilia as forewings. Underside similar, but lines on forewing obsolescent.

Type in Coll. Turner.

N.A., Stapleton, in January; two specimens received from Mr. G. F. Hill.

## ANTHELA RUBICUNDA.

♂ *Darala rubicunda*, Swin., A.M.N.H. (7), ix., p. 419 (1902).

♂ *Anthela phœnicias*, Turn., Tr. R.S.S.A., 1902, p. 182.

♀ *Anthela aspilota*, Turn., Tr. R.S.S.A., 1902, p. 182.

In spite of the difference in colour, the ♂ being roddish-purple and the ♀ ochreous, I now believe these two sexes to be of the same species, which has a wide distribution.

N.Q., Cairns, Stannary Hills. Q., Brisbane, Stanthorpe. N.W.A., Roeburne.

## Fam. THYRIDIDÆ.

*Gen. ABROTESIA, nov.*

*ἀβρωτησιος*, unfit for eating.

Head rounded. Tongue obsolete. (Palpi unknown). Antennæ of ♂ shortly bipectinate. Thorax and abdomen moderately stout. Posterior tibiæ not hairy. Forewings with 7 and 8 stalked, 9 and 10 short-stalked. Hindwings with 5 from below middle of discocellulars, but remote from 4, 6 and 7 remote at origin.

*ABROTESIA GRIPHODES, n. sp.*

*γριφωδης*, reticulated.

♂ 20 mm. Head reddish-brown. (Palpi broken). Antennæ reddish-brown; in ♂ shortly bipectinate (1). Thorax dark-brown; tegulæ and posterior end reddish-brown. Abdomen dark-brown, apices of segments ochreous. Legs brownish-ochreous. Forewings triangular, costa straight, apex round-pointed, termen strongly bowed, oblique; brownish-ochreous coarsely reticulated with brown-fuscous; a broad dorsal streak; a transverse fascia at  $\frac{1}{3}$ , and another at  $\frac{2}{3}$ , with some fine transverse lines before and between fasciæ; coarse reticulations between second fascia and apex; cilia brown-fuscous. Hindwings with termen slightly rounded; similar to forewings, but with fasciæ narrower. Underside similar, but pale-ochreous.

Type in Coll. Turner.

N.A., Port Darwin, in January; one specimen received from Mr. F. P. Dodd.

*Gen. CYDRASTIS, nov.**κνδραστις*, illustrious.

Frons rounded. Tongue well-developed. Palpi long, porrect; terminal joint long, stout, obtuse. Antennæ of ♂ (unknown). Thorax and abdomen moderately stout. Posterior tibiæ hairy. Forewings with 7 and 8 stalked, 9 and 10 parallel and closely approximated. Hindwings with 5 approximated to 4 at origin, 7 from before angle of cell, closely approximated to 8 for a short distance.

Allied to *Aglaopus*, Turn, with which it agrees in neururation, but differs markedly in the palpi.

*CYDRASTIS CARYCINA, n. sp.**καρυκινος*, blood-red.

♀ 24 mm. Head yellowish mixed with red; face bright red. Palpi  $2\frac{1}{2}$ , second joint long, slightly rough-haired; terminal joint  $\frac{1}{2}$  second, smooth; yellowish mixed with red. Thorax and abdomen red mixed with pale-yellow and a few fuscous scales. Legs ochreous; anterior coxæ and femora red anteriorly; anterior tibiæ and tarsi fuscous anteriorly. Forewings triangular, costa moderately arched, apex round-pointed, termen bowed, slightly oblique; bright red with numerous thickly-set pale-yellow spots; costal edge fuscous; a series of fuscous subcostal spots confluent with this; a double transverse row of fuscous spots before middle; some small fuscous spots irregularly scattered in posterior part of disc; cilia yellowish, towards tornus reddish, on dorsum fuscous. Hindwings with termen rounded; as forewings.

Type in Coll. Lyell.

N.Q., Evelyn Scrub, near Herberton; one specimen received from Mr. F. P. Dodd.

*STRIGLINA GLAREOLA.*

*Siculodes ? glareola*, Feld., Reise Nov. Pl. 134, f. 11.

*Songara vittata*, Moore, P.Z.S., 1883, p. 27, Pl. vi., f. 7.

*Songara decussata*, Moore, P.Z.S., 1883, p. 27, Pl. vi., f. 8.

*Striglina sordida*, Pag., Iris v., p. 47.

*Siculodes platyntis*, Meyr., Tr. E.S., 1894, p. 479.

*Striglina duplicifimbria*, Warr., A.M.N.H. (6), xviii., p. 272.

*Striglina decussata*, Hmps., Moths Ind. i., p. 354.

*Striglina glareola*, Hmps., P.Z.S., 1897, p. 613.

This species appears variable. My examples agree fairly well with the description of Sir Geo. Hampson. Moore's figures are poor, Felder's is quite unrecognisable, but I believe Sir Geo. Hampson has examined his type.

N.A., Melville and Bathurst Islands (W. D. Dodd). Also from Java, Borneo, Ceylon, and India.

#### Gen. RHODONEURA.

In my revision of this family (Ann. Q. Mus. x., p. 97), I overlooked an important character. This is a large expanded tuft of scales arising from the base of the costa beneath, and overlying the frenulum. It is present in both sexes, not only in this genus but also in the genera *Oxycophina*, *Hypolamprus*, *Obelura*, and *Addæa*, but is absent in *Striglina* and the other Australian genera of this family.

#### RHODONEURA SPLENDIDA.

*Pharambara splendida*, Butl., A.M.N.H. (5), xx., p. 117 (1887), Hmps. Moths Ind., i., p. 363.

*Pharambara parcipunctalis*, Warr., A.M.N.H. (6), xvii., p. 210.

*Rhodoneura raphiducha*, Turn., Ann. Q. Mus. x., p. 106 (1910).

N.Q., Cairns, Herberton. Also from Solomons and India.

#### RHODONEURA SUBMICANS.

*Dohertya submicans*, Warr., Nov. Zool. xv., p. 330 (1908).

*Rhodoneura crypsilitha*, Turn., Ann. Q. Mus. x., p. 105 (1910).

Q., Brisbane. Also from New Guinea.

#### RHODONEURA GIULIA.

*Rhodoneura giulia*, Swin. A.M.N.H. (7), x., p. 50 (1902).

♀ 22 mm. Head, palpi, and antennæ pale brownish-ochreous. Thorax pale brownish-ochreous, posteriorly whitish. Abdomen brownish-grey, towards base pale brownish-ochreous; a fuscous band on dorsum on apex

of fifth segment. Forelegs brownish-grey, apices of tibiae and tarsal joints whitish; (other legs broken). Forewings; triangular, costa straight to near apex, apex rounded, termen slightly sinuate beneath apex, then strongly bowed, oblique; pale brownish-ochreous, markings pale-fuscous; four rectangular costal spots, first near base, second at  $\frac{1}{4}$ , third before middle, fourth, rather larger, at  $\frac{3}{4}$ ; an oblique streak from mid-dorsum to beneath  $\frac{3}{8}$  costa; a subapical blotch connected with mid-termen; some short transverse strigulae dispersed in disc; cilia whitish barred with fuscous on veins 2, 3, 4, and 7. Hindwings with termen doubly sinuate; colour and strigulae as forewings; a transverse fuscous streak before middle; a second streak from tornus along termen for a short distance; cilia whitish. Underside similar but groundcolour paler, markings dark-fuscous and more clearly defined.

My example corresponds closely to Swinhoe's description, except that in this the ground colour is "orange-red."

N.Q., Evelyn Scrub, near Herberton, in January; one specimen received from Mr. F. P. Dodd. Also from New Guinea.

*RHODONEURA MOLYBDITIS*, *n. sp.*

*μολυβδίτις*, leaden.

♀ 18 mm. Head brownish-ochreous; face fuscous. Palpi pale fuscous, lower edge whitish. Antennae whitish-ochreous. Thorax fuscous-brown; tegulae brownish-ochreous. Abdomen whitish-ochreous partly suffused with fuscous. Legs whitish-ochreous; anterior pair fuscous with whitish annulations. Forewings obovate, costa straight to near apex, apex rounded, termen sinuate beneath apex, strongly bowed on vein 3, oblique; leaden-fuscous with obscure ochreous reticulations towards margins, on costa these are more conspicuous and whitish; cilia ochreous-whitish, barred with dark-fuscous at apex and broadly so opposite veins 3 and 4. Hindwings with termen sinuate beneath apex and bowed on vein 4; ochreous finely reticulated with fuscous; three fuscous fasciae from doismum at base, middle, and tornus, reaching about middle of disc; cilia ochreous with some obscure fuscous bars, apices whitish. Underside whitish-ochreous; forewings with

angular spots more or less confluent, forming interrupted antemedian, postmedian, and subterminal lines, the last connected with mid-termen; hindwings marked as on upper side.

Type in Coll. Turner.

N.A., Port Darwin; one specimen received from Mr. G. F. Hill.

*ADDÆA ANERANNA*, *n. sp.*

*ἀνεραννος*, unlabeled.

♀ 17 mm. Head, palpi, and antennæ ochreous-whitish. Thorax and abdomen ochreous-grey-whitish. Legs ochreous-whitish; tarsi annulated with fuscous. Forewings triangular, costa straight, beyond middle slightly sinuate, apex acute and slightly produced, termen sinuate beneath apex, then strongly bowed, oblique; ochreous-whitish, markings pale brownish-fuscous; costa finely strigulated; an ill-defined basal patch; a postmedian fascia, well defined towards costa, towards dorsum lost in a strigulated dark shade which extends broadly along tornus and termen to beneath apex; cilia ochreous-whitish. Hindwings triangular, apex round-pointed, termen straight; as forewings but without basal patch and postmedian fascia. Underside similar but more distinct.

Type in Coll. Turner.

N.A., Port Darwin; one specimen received from Mr. F. P. Dodd.

Fam. PYRALIDÆ.

Subfam. Crambinæ.

*PLATYTES IDIOPTILA*, *n. sp.*

*ιδιοπτιλος*, with peculiar wing.

♂ 44 mm. Head whitish. Palpi 3; pale ochreous-brown, upper edge and internal surface whitish. Antennæ ochreous-whitish, beneath pale fuscous; in ♂ somewhat thickened and flattened. Thorax whitish, patagia reddish-brown. Abdomen whitish. Legs whitish: anterior pair ochreous-brown anteriorly. Forewings elongate, not dilated, costa moderately arched, apex rounded, tornus deeply incised at vein 3, the incision overhung by a hooklike

projection containing vein 4; whitish, strongly suffused with reddish-brown and fuscous except dorsal area and costal edge; an interrupted fuscous line from beneath  $\frac{2}{3}$  costa, outwardly oblique, then bent strongly inwards towards  $\frac{2}{3}$  dorsum; cilia grey, apices whitish, on apex whitish, on hook fuscous, on incision whitish. Hindwings more than twice breadth of forewings, termen sinuate; whitish, thinly scaled; cilia whitish.

Type in Coll. Turner.

N.S.W., Brewarrina; one specimen received from Mr. W. W. Froggatt. Very little is yet known of the lepidoptera of the western interior, and the advent of this large and remarkable form shows that there is still much to be discovered.

Subfam. Schoenobianæ.

Gen. STYPHLOLEPIS.

Hmps., P.Z.S., 1895, p. 912.

I have but one example (♀) of *S. squamosalis*, the only described species, and in this veins 6 and 7 of the forewings are separate at origin, not stalked, as stated by Hampson. I mention this as the latter structure, which is peculiar, occurs in the ♂ of the following species. Probably the difference in neurulation is sexual.

STYPHLOLEPIS AGENOR, *n. sp.*

ἀγνηρός, splendid.

♂ 46-48 mm. Head whitish-grey. Palpi 3; whitish-grey, base beneath white. Antennæ of ♂ flattened, thickened towards base, and shortly laminate; ochreous-fuscous. Thorax and abdomen grey. Legs whitish. Forewings with costa straight for  $\frac{3}{4}$ , then moderately arched, apex acute, termen sinuate beneath apex and above costa, in middle rather strongly bowed, oblique; 6 and 7 stalked in ♂ separate in ♀, 7, 8, 9, 10 stalked; grey-whitish coarsely irrorated with dark grey; some ochreous suffusion near base; a faint oblique grey line at  $\frac{2}{3}$ ; cilia fuscous with a white patch above tornus. Hindwings with termen gently rounded; orange-ochreous towards apex suffused with grey; a short fine grey line from  $\frac{3}{4}$  costa parallel to

termen; cilia whitish, on apex grey, with a fuscous basal line except on tornus and dorsum.

Type in Coll. Turner.

N.S.W., Brewarrina; two specimens received from Mr. W. W. Froggatt, who informs me that the larvæ bore the stems of *Capparis mitchelli*, feeding for about twelve months in the wood and finally killing the tree. This is an even finer discovery than the previous species described from the same locality.

### Subfam. Pyralinæ.

CANGETTA AMMOCHROA, *n. sp.*

ἀμμοχροός, sand-coloured.

♂ 10 mm. Head pale-brown; face whitish. Palpi pale-brown; apex of second joint blackish; terminal joint white. Antennæ brown-whitish. Thorax pale-brown. Abdomen pale-brown, apices of segments whitish, but apex of ninth segment blackish. Legs whitish. Forewings triangular, costa straight, arched towards apex, apex rounded, termen rounded, scarcely oblique; pale-brown; a costal fuscous streak to  $\frac{1}{3}$ ; two brown transverse lines, fuscous on costa; first at  $\frac{1}{3}$ , outwardly curved; second from  $\frac{2}{3}$  costa to  $\frac{3}{4}$  dorsum, nearly straight; four or five brown-fuscous dots on apical half of termen, edged by a narrow whitish shade; cilia white with a fuscous sub-basal line. Hindwings with termen gently rounded; as forewings but without first line; a line from  $\frac{2}{3}$  costa forming a v-shaped curve in disc, and ending on dorsum near tornus.

Type in Coll. Turner.

N.A., Port Darwin, in January; one specimen received from Mr. F. P. Dodd.

Gen. TANAOBELA, *nov.*

ταναιοβελος, with long weapons (palpi).

Frons with a short projecting tuft. Tongue present. Palpi extremely long (12), porrect; second joint extremely long, thickened with long loose scales above and beneath; terminal joint about  $\frac{1}{2}$  second, spatulate, much thickened with loosely spreading scales at apex. Maxillary palpi long (1), triangularly dilated with scales. (Antennæ of ♂

unknown). Forewings with discocellulars very obliquely angled inwards, 2 from  $\frac{2}{3}$ , 3 from well before angle, 4 from angle, 5 from a little above angle, 6, 7, 8, 9 stalked, 6 and 7 arising by a common stalk which is very shortly coincident with that of 8, 9, 10 from well before upper angle, 11 from  $\frac{2}{3}$ , running into 12. Hindwings with 4 and 5 stalked, 6 and 7 connate, 7 anastomosing with 8 for a short distance.

This peculiar genus with its extraordinary palpi appears to be nearest *Lamacha*, Wlk. (Hmps. Tr. E.S., 1896, p. 526), though in this genus vein 7 of the hindwings and veins 6 and 11 of the forewings are free.

TANAOBELA CHRYSOCHLORA, n. sp.

χρυσοχλωρος, golden green.

♀ 20 mm. Head yellowish-green. Palpi pinkish-white densely irrorated with fuscous, inner surface whitish-ochreous. Antennæ pale ochreous-fuscous. Thorax yellowish-green. Abdomen pale-ochreous. Legs ochreous-whitish; anterior and middle tarsi annulated with dark-fuscous, posterior tarsi with pinkish. Forewings triangular, costa nearly straight, apex rounded-rectangular, termen straight, slightly oblique; yellowish-green without defined markings; a brownish streak on base of costa, and a minute dot beneath mid-costa; traces of a pale-fuscous dentate transverse line at  $\frac{5}{8}$ ; some fuscous suffusion at tornus; cilia dark brownish-fuscous. Hindwings with termen strongly rounded; pale-pinkish; a narrow dark-fuscous sub-dorsal blotch, from the base of which arises a long tuft of pinkish hairs; cilia grey, on dorsum whitish.

Type (damaged) in Coll. Turner.

\* N.Q., Kuranda, near Cairns, in May; one specimen received from Mr. F. P. Dodd.

TITANOCEROS CATAPHANES.

*Axiocrita cataphanes*, Turn., P.R.S.Q., 1912, p. 136.

The genus *Axiocrita* must be dropped unless the ♂ shows reason for its retention. My type is a ♀; my error arose from overlooking the fact that in this group there is a single bristle in the frenulum in both sexes. The species is very similar to the ♀ of *T. cataxantha*, Meyr.,

but is certainly distinct. The much longer slender palpi, and the snow-white spot on base of anterior coxæ are in themselves sufficient distinctions.

MACALLA ZOPHERA.

*Macalla zophera*, Turn., P.R.S.Q., 1903, p. 196.

*Macalla mixtirosalis*, Hmps., A.M.N.H. (7), xvii., p. 135 (1906).

Q., Duaringa, Brisbane.

MACALLA PENTABELA, *n. sp.*

πενταβελος, with five arrows, or darts.

♂ 35 mm. Head greenish-fuscous. Palpi greenish-fuscous with some whitish scales. Antennæ fuscous; in ♂ dentate with fascicles of rather long cilia ( $1\frac{1}{2}$ ); antennal processes dark-fuscous. Thorax reddish-whitish; patagia and tegulæ greenish. Abdomen whitish rather densely irrorated with fuscous. Legs dark-fuscous mixed with reddish and whitish scales; tarsi annulated with whitish. Forewings triangular, costa almost straight, a slight incision at  $\frac{2}{3}$  precoded by a small glandular (?) thickening, apex round-pointed, termen bowed, slightly oblique; whitish suffused with greenish and irrorated with dark fuscous; a strong tuft of raised scales in disc at  $\frac{1}{2}$ , anteriorly whitish posteriorly dark-fuscous; a dark fuscous line from  $\frac{1}{2}$  costa to dorsum before middle; a finely dentate slender fuscous line edged posteriorly with whitish, bent first outwards and then inwards to  $\frac{3}{4}$  dorsum; median area whitish towards costa; a whitish subcostal tuft just beyond first line; a suffused dark-fuscous broad line from dorsal end of first line curved outwards along edge of cell, and emitting five slender streaks along veins 1, 2, 3, 4, and 5; terminal area whitish towards tornus; a terminal series of whitish dots on ends of veins; cilia reddish-whitish barred with fuscous. Hindwings with termen gently bowed; whitish, towards termen fuscous; a short dentate line from  $\frac{2}{3}$  costa, terminal dots and cilia as forewings. Underside of forewings with dentate postmedian line well marked.

Type in Coll. Goldfinch.

N.S.W., Mount Kosciusko (5,000ft.), in January; one specimen taken by Mr. G. N. Goldfinch.

MACALLA EUPEPLA, *n. sp.*

εὐπεπλος, well-clothed.

♀ 36 mm. Head ochreous-green mixed with white. Palpi ochreous-green mixed with white and rosy; terminal joint rosy, apex whitish. Antennæ ochreous-green, at base mixed with white and rosy. Thorax ochreous-green mixed with whitish and rosy. Abdomen white mixed with fuscous and rosy, towards base and at apex suffused with ochreous-green. Legs fuscous, annulated with white and irrorated with rosy. Forewings triangular, costa straight, slightly arched towards apex, apex rounded, termen obliquely rounded; ochreous-green patchily irrorated with fuscous, white, and rosy scales; a triangular basal patch extending to  $\frac{1}{3}$ , its outer portion wholly ochreous-green; a transverse rosy line following this; a white spot on costa at  $\frac{2}{3}$ , extending as a dentate line a short way into disc, at its extremity two blackish dots; a white spot above dorsum at  $\frac{2}{3}$  edged anteriorly and posteriorly with blackish; some short blackish streaks on veins beyond  $\frac{2}{3}$ ; a rosy and white terminal shade, with a terminal series of ochreous-green spots; cilia whitish, bases barred with ochreous-green, apices with pale-rosy. Hindwings with termen rounded; whitish; towards termen shaded with fuscous; cilia as forewings.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in June; one specimen received from Mr. F. P. Dodd.

## EPIPASCHIA OLETOLIS.

Also in British Museum from New Guinea.

## ORTHAGA PICTA.

*Stricta picta*, Warr., A.M.N.H. (6), xvi., p. 461.

N.Q., Kuranda near Cairns, in June; one ♂ specimen (Dodd).

## Gen. TERMIPTYCHA.

*Termioptycha*, Meyr., Tr. E.S., 1889, p. 504; Hmps., Tr. E.S., 1896, p. 451.

*Sialocyttara*, Turn., P.R.S.Q., 1912, p. 134.

My description needs amendment in two particulars. The forewing of ♂ is not abbreviated, but the termen is

broadly folded over beneath, and vein 10 anastomoses with 9 beyond 7 in both sexes.

TERMIOPTYCHA CYANOPA.

*Termioptycha cyanopa*, Meyr., Tr. E.S., 1889, p. 505.

*Sialocyttara erasta*, Turn., P.R.S.Q., 1912, p. 134.

N.Q., Cairns. Also from New Guinea.

Subfam. Pyraustinae.

Gen. THOLERASTIS, nov.

θολεραστις, turbid, muddy.

Frons not projecting. Tongue present. Palpi long, ascending, recurved; terminal joint as long as second, slender, acuminate. Maxillary palpi moderately dilated. Forewings rather narrow, 5 absent, 8, 9, 10, 11 stalked. Hindwings with 5 absent, 8 anastomosing with cell and with 7. A derivative of *Nymphula*.

THOLERASTIS ELAPHRA, n. sp.

ἐλαφρος, light.

♀ 16 mm. Head, palpi, antennae, and thorax fuscous. Abdomen and legs pale fuscous. Forewings narrowly triangular, costa straight for  $\frac{2}{3}$ , gently arched towards apex, apex rounded, termen obliquely rounded; fuscous-whitish suffused with fuscous; a fuscous spot beneath costa just beyond middle; a pale submarginal line; cilia fuscous-whitish with a fuscous basal line. Hindwings with termen rounded; whitish with some pale grey suffusion; cilia whitish with a grey basal line.

Type in Coll. Turner.

Q., Killarney, in November; one specimen.

CATACLYSTA PERICOMPSA, n. sp.

περικομπος, exquisite.

♂ ♀ 11-14 mm. Head, whitish. Palpi  $1\frac{1}{2}$ ; fuscous, apices whitish. Antennae fuscous-whitish; ciliations in ♂  $\frac{1}{4}$ . Thorax fuscous; patagia mostly whitish. Abdomen fuscous or ochreous-brown, beneath whitish. Legs whitish; anterior coxae and femora fuscous; anterior tibiae and tarsi annulated with fuscous. Forewings elongate-

triangular, costa gently arched, apex round-pointed, termen slightly rounded, oblique; 10 from cell; brownish-ochreous sometimes partly suffused with fuscous; markings white edged with fuscous; short broad subcostal and dorsal streaks from base; two sickle-shaped fasciæ from dorsum at  $\frac{1}{3}$  and  $\frac{2}{3}$ , outwardly curved, not quite reaching costa, narrowly connected beneath costa; a subcostal spot just beyond second fascia; a dorsal spot at  $\frac{2}{3}$ ; a bar from  $\frac{3}{4}$  costa to about middle of disc; a subterminal fascia from costa ending above tornus, mostly suffused with fuscous; cilia white with a dark-fuscous basal line, on apex and tornus fuscous. Hindwings with termen rounded; 7 and 8 coincident; colour as forewings; basal streaks present or absent; a transverse fascia at  $\frac{1}{2}$  sometimes interrupted by a fuscous septum; a fascia from  $\frac{3}{4}$  costa describing a sharp curve before apex and continued to dorsum near tornus, its curve including anteriorly an elongate spot; a black subterminal streak from beneath apex to before tornus, connected by bars with termen, and including five or six silvery dots; cilia white with a fuscous basal line.

Type in Coll. Turner.

N.A., Port Darwin; five specimens received from Mr. G. F. Hill.

*MUSOTIMA STICTOCHROA*, n. sp.

*στικτοχροός*, speckled.

♀ 14 mm. Head whitish, irrorated with dark-fuscous. Palpi whitish with dark-fuscous annulations. Antennæ dark-fuscous. Thorax dark-fuscous with some whitish scales. Abdomen dark-fuscous mixed with whitish-ochreous, apices of segments whitish. Legs fuscous; tarsi partly whitish. Forewings triangular, costa twice sinuate, apex rounded; termen deeply sinuate beneath apex, then strongly bowed, incised above tornus; moderately oblique; dark-fuscous with some whitish-ochreous irroration; a fine whitish transverse line at  $\frac{1}{3}$ , angled outwardly in middle; a large oblong white discal spot beyond middle; a second fine whitish line from  $\frac{4}{5}$  costa parallel to termen, then bent to below discal spot, and again bent at right angle to end in  $\frac{2}{3}$  dorsum; a white subapical dot giving rise to an obscure

subterminal line of dots, ending in a white subternal dot; cilia fuscous barred with white beneath apex, in sinuation, and in subternal incision. Hindwings with termen deeply sinuate beneath apex, irregularly dentate towards tornus; colour as in forewings; a curved transverse whitish line at  $\frac{1}{4}$ ; a white discal spot before middle; a whitish line from  $\frac{3}{4}$  costa at first sinuate and approaching termen, dentate in middle, then bent inwards, and again bent to end in dorsum above tornus; cilia dark-fuscous, irregularly barred with white.

Type in Coll. Turner.

N.S.W., Ebor (4,000ft.), in January; one specimen.

*Gen. TRIGONOBELA, nov.*

*τριγωνοβελος*, with triangular weapons (palpi).

Frons flat. Tongue well-developed. Palpi moderately long, curved, ascending; basal and second joint densely clothed with long scales beneath, forming a triangular mass on second joint; terminal joint triangularly scaled, and forming an angle with second joint. Maxillary palpi filiform. (Antennæ in ♂ unknown). Posterior tibiæ with outer spurs about  $\frac{1}{2}$  inner. Forewings with 3, 4, 5 approximated at base, 6 from above middle, 7 approximated at base to 8 and nearly straight, 8, 9 long-stalked, 10 separate but closely approximated to their common stalk. Hindwings with 3, 4, 5 approximated at base, and 4, 5 approximated for a short distance, 6 and 7 connate, 7 anastomosing with 8 for about  $\frac{1}{2}$  its length.

The terminal joint of labial palpi resembles that of *Agrotera*, but in that genus the scaling of the first and second joints forms three distinct triangles.

*TRIGONOBELA NEBRIDOPEPLA, n. sp.*

*νεβριδοπεπλος*, clad in a fawn-skin.

♀ 34 mm. Head whitish-ochreous. Palpi fuscous-brown, base sharply ochreous-whitish. Antennæ pale-brown. Thorax and abdomen pale-brown. Legs brown-whitish; anterior tibiæ and tarsi annulated with fuscous. Forewings elongate-triangular, costa scarcely arched, apex round-pointed, termen bowed, strongly oblique; pale-brown

with pale-fuscous markings, and pale-ochreous spots; a dentate transverse line at  $\frac{1}{4}$ ; a pale-centred discal spot before middle; a dentate line from  $\frac{3}{4}$  costa, obsolete towards dorsum, preceded and followed by some small pale-ochreous spots; a subterminal series of pale-fuscous spots, succeeded by a series of pale-ochreous spots; cilia pale-fuscous. Hindwings with termen slightly sinuate; colour and markings as forewings but lines not dentate.

In its peculiar colouring and faint ill-defined markings this species is not like any other.

Type in Coll. Turner.

N.A., Port Darwin, in October; one specimen received from Mr. F. P. Dodd, with the note that the larva is an internal feeder in a species of scrub cane.

SYLEPTA POLYTIMETA, n. sp.

πολυτιμητος, precious.

♂ 25 mm. Head yellow; face whitish-yellow. Palpi whitish-yellow; basal joint black. Antennæ whitish-ochreous; ciliations in ♂ 1. Thorax yellow. Abdomen yellow, apices of segments white, but apices of ninth and tenth segments black. Legs whitish-yellow; anterior tarsi, apex of anterior tibiae and base of anterior and middle tibiae annulated with black. Forewings triangular, costa straight, gently arched beyond middle, apex round-pointed, termen slightly bowed, oblique; whitish with five partly-connected deep-yellow transverse fasciæ, near base, at  $\frac{1}{4}$ , at middle, at  $\frac{3}{4}$ , and on termen; four conspicuous black spots, on costa near base, on costa at  $\frac{1}{4}$ , in disc beneath midcosta, and on costa at  $\frac{3}{4}$ ; a fine blackish terminal line, broader beneath apex; cilia whitish. Hindwings with termen slightly sinuate; as forewings but with only four yellow fasciæ, which are obsolete towards costa, and with only one black spot at apex.

Type in Coll. Turner.

N.A., Port Darwin, in December; one specimen received from Mr. F. P. Dodd, and I have seen another from the same locality.

SYLEPTA ZOPHOSTICTA, *n. sp.*

ζοφοστικτος, dark-spotted.

♂ 24 mm. Head whitish-ochreous; lower half of face fuscous. Palpi white; terminal joint and apices of first and second joints dark-fuscous. Antennæ whitish; ciliations in ♂ 1. Thorax whitish-ochreous; shoulders narrowly dark-fuscous. Abdomen ochreous-whitish with a pair of dark-fuscous dots on apex of second segment. Legs whitish, base and apex of anterior tibiæ and terminal joints of anterior tarsi dark-fuscous. Forewings triangular, costa straight, arched towards apex, apex round-pointed, termen slightly bowed, oblique; whitish-ochreous; a fuscous streak along costa throughout; dots dark-fuscous; one on dorsum near base; one at  $\frac{1}{3}$  just beneath costal streak; another larger similarly placed at middle; a line of fine dots from  $\frac{3}{4}$  costa, bent outwards in disc, again bent inwards, and ending in a dot above  $\frac{2}{3}$  dorsum; cilia whitish. Hindwings with termen gently rounded; colour and cilia as forewings; a large median discal dot at  $\frac{1}{3}$ ; a line of fine dots from costa at  $\frac{3}{4}$ , slightly bent outwards in disc, obsolete towards dorsum, but represented by a dot on dorsum at  $\frac{3}{4}$ ; a spot on apex.

Type in Coll. Turner.

N.A., Port Darwin, in December; one specimen received from Mr. F. P. Dodd.

SYLEPTA EMMETRIS, *n. sp.*

ἐμμετρος, measured, moderate.

♀ 27 mm. Head whitish-ochreous; face whitish. Palpi whitish, towards apex greyish. Antennæ whitish-ochreous. Thorax whitish-ochreous. Abdomen ochreous-whitish. Legs whitish; base and apex of anterior tibiæ pale-fuscous. Forewings triangular, costa straight, arched towards apex, apex round-pointed, termen nearly straight, oblique; whitish-brown-ochreous; markings fuscous; a line from  $\frac{1}{6}$  costa to  $\frac{1}{4}$  dorsum, slightly curved outwards; a transverse discal mark before middle; a line from  $\frac{2}{3}$  costa, slightly dentate at commencement, curved a little outwards in disc, then bent inwards at a right angle to beneath discal mark, bent again at a right angle, and ending on  $\frac{2}{3}$

dorsum; cilia ochreous-whitish. Hindwings with termen rounded; as forewings but without first line.

Type in Coll. Turner.

N.A., Port Darwin, in November; one specimen received from Mr. F. P. Dodd.

*SYLEPTA PLACOPHÆA*, *n. sp.*

*πλακοφαίος*, broadly fuscous.

♀ 36 mm. Head and thorax fuscous. Palpi with terminal joint slender, acute; fuscous. Antennæ fuscous. Abdomen fuscous, towards base fuscous-whitish. Legs fuscous; anterior tibiæ and all tarsi annulated with whitish-ochreous. Forewings triangular, costa gently arched, more strongly towards apex, apex round-pointed, termen bowed, oblique; brown-whitish, markings fuscous; a moderate basal patch; a subcostal spot at  $\frac{1}{3}$ , succeeded by an oval pale-centred subcostal spot; a dentate line from  $\frac{2}{3}$  costa, bent inwards below middle to beneath second spot, and then at a right angle to  $\frac{2}{3}$  dorsum; a broad terminal fascia separated from the preceding by a fine dentate whitish line; cilia fuscous, bases barred with whitish. Hindwings with termen rounded; fuscous, towards base suffused with brown-whitish; a median fuscous pale-centred spot at  $\frac{1}{3}$ ; a whitish subcostal spot at  $\frac{1}{3}$ , giving rise to a fine dentate whitish line as far as vein 2; a whitish line from vein 2 at middle of disc nearly to tornus; cilia as forewings.

Type in Coll. Turner. Referred to this genus for the present, but the slender acute terminal joint of palpi renders its position doubtful.

N.Q., Kuranda, near Cairns, in January; one specimen received from Mr. F. P. Dodd.

*SYLEPTA HICANA*, *n. sp.*

*ίκανος*, befitting.

♂ ♀ 17-21 mm. Head whitish-ochreous. Palpi fuscous; base sharply white; terminal joint short, obtuse, whitish. Antennæ whitish-ochreous; ciliations in ♂ extremely minute. Thorax whitish-ochreous, towards base mixed with white; terminal segment white with fuscous apex and whitish-ochreous tuft. Legs whitish; anterior

coxae and femora pale-fuscos; anterior tibiae and tarsi annulated with fuscous. Forewings triangular, costa straight to near apex, apex round-pointed, termen bowed, strongly oblique; whitish-ochreous with some pale-fuscos suffusion especially on costa; a white subcostal dot at  $\frac{1}{3}$ ; a squarish white subcostal spot, outlined with fuscous, at  $\frac{1}{3}$ ; a fuscous line from anterior margin of this to  $\frac{1}{3}$  dorsum; a fuscous line from  $\frac{2}{3}$  costa very obliquely outwards for a short distance, then acutely toothed and transverse to middle of disc; space between this and following line clear white; a dentate line from shortly beyond preceding, at first transverse, then bent inwards at a right angle to beneath middle of disc, again bent and sinuate to  $\frac{3}{4}$  dorsum; cilia fuscous, apices clear white. Hindwings with termen slightly rounded; whitish-ochreous with fuscous lines; a dentate transverse line at  $\frac{1}{3}$ ; a dentate line from  $\frac{2}{3}$  costa gradually approaching termen, beyond middle sharply bent inwards and continued to  $\frac{2}{3}$  dorsum; a fuscous terminal line; cilia white, towards tornus with a fuscous basal line.

Sir Geo. Hampson refers this species to the genus *Samea*.

Type in Coll. Turner.

N.A., Port Darwin, in October and January; two specimens received from Mr. F. P. Dodd.

#### TYSPANODES METACHRYSIALIS.

*Tyspanodes metachrysalis*, Low., Tr. R.S.S.A., 1903, p. 63.

*Tyspanodes phæosticha*, Turn., P.R.S.Q., 1912, p. 146.

#### Gen. TORQUEOLA.

*Torqueola*, Swin., A.M.N.H. (7), xvii., p. 382 (1906).

Frons flat. Tongue well-developed. Palpi moderately long, ascending, appressed to face; second joint moderately thickened with loosely appressed scales, but not dilated nor tufted, terminal joint short, obtuse, dilated fanwise with loose scales. Maxillary palpi minute. Antennæ of ♂ with basal joint much dilated and excavated into a deep notch on inner side, with a short corneous spine from lower margin of notch, then simple to  $\frac{1}{3}$ , from  $\frac{1}{3}$  to middle dilated and shortly bipectinate, from middle to apex slightly

serrate with short ciliations. Forewings with 7 curved at base, 10 closely approximated to 9. Hindwings with 4 and 5 approximated for a short distance, 6 and 7 connate, 7 anastomosing with 8 for half its length.

Type *Botys ophiceralis*, Wlk., from Java. The ♂ antennæ are highly specialised. Sir Geo. Hampson makes it a section of the genus *Glyphodes*, but I think the palpi are very different.

TORQUEOLA HYPOLAMPRA, *n. sp.*

ὄπολαμπρος, brilliant beneath.

♂ 36 mm. Head, palpi, and antennæ dark-fuscous. Thorax and abdomen dark-fuscous; pectus shining snow-white. Legs fuscous. Forewings elongate-triangular, costa rather strongly arched, apex round-pointed, termen nearly straight, very oblique; dark-fuscous with a purple gloss; cilia fuscous. Hindwings rather elongate, termen slightly rounded; colour and cilia as forewings.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in February; one specimen received from Mr. F. P. Dodd.

MARGARONIA HYALOPTILA, *n. sp.*

ὄαλοπτιλος, with transparent wings.

♀ 28 mm. Head fuscous-whitish; face and palpi pale-fuscous. Antennæ grey. Thorax and abdomen whitish irrorated with pale-fuscous. Legs whitish; anterior pair pale fuscous. Forewings elongate-triangular, costa straight, towards apex arched, apex round-pointed, termen slightly bowed, oblique; whitish, thinly-scaled, semi-transparent, with a purplish gloss when viewed obliquely; markings pale-fuscous outlined with darker fuscous; a dot on dorsum near base; a thick streak on basal fourth of costa, with two triangular expansions, first in middle, second near distal end; an incomplete fascia from immediately beneath mid-costa with crenated margins, bent inwards in disc, and ending in a rounded extremity above mid-dorsum; a thick interrupted dentate subterminal line; a fine terminal line; cilia whitish. Hindwings with termen gently rounded; colour as forewings; a fine fuscous

streak along median vein, ending in an irregular fuscous annulus before mid-disc; subterminal and terminal lines and cilia as forewings.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in November; one specimen received from Mr. F. P. Dodd.

*MARASMIA LOXODESMA*, *n. sp.*

*λοξοδεσμος*, obliquely banded.

♂ 14 mm. Head and thorax fuscous-whitish. Palpi fuscous, base sharply white. Antennæ whitish; ciliations in ♂ minute. Abdomen fuscous-whitish, base whitish. Legs whitish; anterior pair fuscous. Forewings triangular, costa straight almost to apex, apex round-pointed, termen bowed, oblique; whitish with some fuscous suffusion at base and on costal part of disc, lines fuscous; a line from  $\frac{1}{4}$  costa, obliquely curved in disc to  $\frac{1}{4}$  dorsum; a similar line from costa before middle to dorsum before middle; a third line from  $\frac{3}{4}$  costa to  $\frac{3}{4}$  dorsum; a subterminal line from costa shortly before this, sinuate, not reaching tornus; a fuscous terminal line; cilia fuscous, bases narrowly whitish. Hindwings with termen gently rounded; as forewings.

Type in Coll. Turner.

N.A., Port Darwin, in October; one specimen received from Mr. F. P. Dodd.

*METASIA PHRAGMATIAS*.

*Metasia phragmatias*, Low., Tr. R.S.S.A., 1903, p. 66.

*Metasia diplophragma*, Turn., Tr. R.S.S.A., 1908, p. 97.

N.Q., Townsville.

*METASIA ORPHNOPIS*, *n. sp.*

*ορφνωπις*, dusky.

♂ ♀ 20 mm. Head and thorax fuscous. Palpi 3; fuscous, beneath white. Antennæ fuscous; ciliations in ♂  $\frac{1}{4}$ . Abdomen fuscous, beneath whitish. Legs fuscous-whitish; anterior pair fuscous, tarsi annulated with whitish. Forewings triangular, costa slightly sinuate, arched towards apex, apex rounded, termen sinuate, oblique; fuscous;

lines dark-fuscous; antemedian from  $\frac{1}{4}$  costa to  $\frac{1}{3}$  dorsum, indistinct; postmedian from  $\frac{3}{4}$  costa to  $\frac{2}{3}$  dorsum, slightly dentate, partly edged posteriorly with whitish, at first straight, then bent outwards, and again inwards, and finally bent at a right angle towards dorsum; a square whitish subcostal discal spot before middle; cilia fuscous, bases narrowly whitish. Hindwings with termen rounded; as forewings; antemedian line curved, interrupted; postmedian line not reaching much more than half across disc.

Type in Coll. Turner.

Q., Killarney, in November; eight specimens.

*METASIA CROCOPHARA*, *n. sp.*

*κροκοφορος*, saffron-robed.

♂ 11 mm. Head ochreous. Palpi fuscous, lower edge towards base sharply white. Antennæ whitish-grey. Thorax orange-yellow. Abdomen ochreous. Legs white; anterior pair fuscous anteriorly. Forewings triangular, costa straight to near apex, apex pointed, termen sinuate, oblique; orange-yellow, towards apex brownish-tinged; a broad brown-fuscous streak along costa to  $\frac{2}{3}$ ; a fuscous line from  $\frac{2}{3}$  costa, distinct at commencement, but soon becoming slender and very obscure, apparently looped inwards in disc and then bent to end in  $\frac{2}{3}$  dorsum; a fuscous terminal line; cilia with basal half white, apical half dark-fuscous. Hindwings with termen rounded towards tornus; yellow, towards termen brownish-tinged; terminal line and cilia as forewings.

Type in Coll. Turner.

Q., Stradbroke Island, in December; one specimen. I have a second ♀ example from Stanthorpe, Q., in November, larger, more brightly coloured, and with the apices of the cilia white.

*METASIA ASPHYCTA*, *n. sp.*

*ἀσφνκτος*, feeble.

♂ ♀ 10 mm. Head whitish-ochreous. Palpi fuscous, lower edge narrowly whitish. Antennæ with joints slightly dilated at apices; ochreous-whitish; ciliations in

♂ minute. Thorax and abdomen whitish-ochreous. Legs whitish; anterior pair pale-fuscous. Forewings elongate-triangular, costa straight, apex round-pointed, termen slightly sinuate, oblique; whitish suffused with brownish-ochreous and on costa and termen with fuscous; lines fuscous; first from  $\frac{1}{3}$  costa to  $\frac{1}{3}$  dorsum, nearly straight; second from  $\frac{2}{3}$  costa, bent outwards in disc, and then bent inwards below middle, ending on  $\frac{2}{3}$  dorsum; cilia fuscous, apices whitish. Hindwings with termen gently rounded; whitish with faint brownish-ochreous suffusion; an outwardly curved transverse line at  $\frac{2}{3}$ ; a broad pale-fuscous terminal suffusion; cilia as forewings.

Type in Coll. Turner.

N.A., Port Darwin, in February; two specimens received from Mr. F. P. Dodd.

*METASIA ECBLETA*, *n. sp.*

*ἐκβλητος*, despised.

♂ 11 mm. Head, thorax, and palpi fuscous. Antennæ fuscous; ciliations in ♂ minute. Abdomen grey. Legs whitish; anterior pair fuscous. Forewings narrowly triangular, costa gently arched, apex round-pointed; termen slightly rounded, oblique; ochreous-whitish with fuscous markings and irroration; a fuscous streak along costa to middle, another from base expanding into an irregular spot in mid-disc before middle, and a third much shorter on base of dorsum; an outwardly curved line from mid-costa to mid-dorsum; a terminal suffusion containing five or six ochreous-whitish terminal dots; cilia fuscous-whitish. Hindwings with termen rounded; grey; cilia grey.

Type in Coll. Turner.

N.A., Port Darwin, in October; one specimen received from Mr. F. P. Dodd.

*CALAMOCHROUS ASPILUS*, *n. sp.*

*ἀσπιλος*, spotless.

♀ 25 mm. Head, thorax, and antennæ whitish-brown. Palpi 3; whitish-brown; lower edge of basal and terminal joints whitish. Abdomen whitish-brown, sides whitish.

Legs whitish-brown; posterior pair whitish. Forewings triangular, costa straight, (apices broken), termen obliquely rounded; uniform whitish-brown without markings; cilia pale-brown. Hindwings with termen rounded; whitish, thinly scaled, towards apex slightly brownish-tinged; cilia whitish, slightly brownish-tinged except on tornus and dorsum.

Type in Coll. Turner.

N.A., Port Darwin, in November; one specimen received from Mr. F. P. Dodd.

#### NOORDA AMETHYSTINA.

*Autocharis amethystina*, Swin., A.M.N.H. (6), xiv., p. 149.

*Noorda hedyphaës*, Turn., P.R.S.Q., 1912, p. 155.

Distinct from *N. fessalis*, Swin., I think.

#### PYRAUSTA EPICROCA.

*Pyrausta epicroca*, Low., Tr. R.S.S.A., 1903, p. 67.

*Pyrausta perflavalis*, Hmps., A.M.N.H. (8), xii., 23 (1913).

N. Q., Cairns, Stannary Hills, Townsville. Q., Brisbane, Mt. Tambourine. N.S.W., Sydney. Also from Louisiades.

#### PYRAUSTA PETROSARCA.

*Pyrausta petrosarca*, Low., Tr. R.S.S.A., 1903., p. 68.

*Pyrausta apocrypha*, Turn., Tr. R.S.S.A., 1908, p. 101.

N.Q., Cooktown? (Lower). Q., Brisbane.

#### MYRIOSTEPHES CALLIPEPLA, *n. sp.*

*καλλιπεπλος*, beautifully clothed.

♂ 12 mm. Head brown-whitish; face fuscous. Palpi 3; fuscous, beneath white. Antennæ dark-fuscous; in ♂ with a double row of long pectinations (3). Thorax dark-fuscous. Abdomen whitish. Legs dark-fuscous; posterior pair whitish; anterior and middle tarsi annulated with white. Forewings triangular, costa straight to near apex, apex rounded, termen obliquely rounded; dark-fuscous; markings snow-white; a broad bar from  $\frac{1}{2}$  dorsum nearly reaching costa; a fascia from  $\frac{2}{3}$  costa to  $\frac{2}{3}$  dorsum, expanded on costa, its posterior edge irregular; a subterminal streak

from tornus not reaching apex; a series of minute sub-marginal lunules; cilia fuscous with a pale median line. Hindwings with termen rounded; white; a pale-fuscous line at  $\frac{2}{3}$  not reaching dorsum; a similar line on termen; cilia white, bases pale-fuscous.

Differs from the other species in the ♂ pectinate antennæ, but I doubt whether this will justify generic separation.

Type in Coll. Turner.

N.A., Port Darwin; one specimen received from Mr. G. F. Hill.

*Gen. PERIMECETA, nov.*

*περιμηκετος*, long.

Frons flat, oblique. Tongue well-developed. Palpi long, porrect; second joint very long, stout, smooth-scaled; terminal joint exposed, rather long, obtuse. Antennæ of ♂ (unknown). Posterior tibiæ with outer spurs half inner. Forewings very long; 8, 9, 10 stalked. Hindwings normal.

Probably allied to *Otiophora*, Turn., in spite of the stalking of vein 10. The ♂ may show additional characters.

*PERIMECETA NIPHOTYPA, n. sp.*

*νιφοτυπος*, snow-marked.

♀ 30 mm. Head fuscous-brown; lateral margins of face whitish. Palpi 3; fuscous-brown, extreme base white. Antennæ fuscous-brown. Thorax fuscous-brown; pectus white. Abdomen and legs brown. Forewings narrow-elongate-triangular, costa gently arched, apex rounded, termen obliquely rounded; fuscous-brown; a snow-white streak from base to  $\frac{1}{4}$ , at first subcostal, then bent downwards along fold, twice interrupted so as to form three spots in longitudinal series; an inverted "comma" shaped snow-white spot in disc just beyond middle; a white costal mark at  $\frac{1}{2}$ ; a white dot on termen beneath apex, from it a series of dark dots in a straight line towards  $\frac{3}{4}$  dorsum; cilia brown, a darker basal line interrupted by white dots. Hindwings broad, termen slightly sinuate; pale-brownish,

rather thinly scaled; cilia whitish with a brown basal line.

Type in Coll. Goldfinch.

N.S.W., Tarco, in September; one specimen.

Gen. *THESAURICA*, nov.

*θησαυρος*, a treasure.

Frons with a bluntly triangular prominence. Tongue well-developed. Palpi moderate, porrect, terminal joint downcurved. Maxillary palpi filiform. Forewings with tufts of raised scales; 2 from  $\frac{3}{4}$ , 3 from just before angle, 4, 5 approximated at base from angle, 8, 9 stalked, 10 approximated to them. Hindwings with 4, 5 approximated for a short distance, 6, 7 connate, 7 anastomosing with 8 for less than half its length.

The combination of a triangularly projecting frons with tufted forewings makes this a very distinct genus.

*THESAURICA ARGENTIFERA*.

*Sameodes argentifera*, Hmps., A.M.N.H. (8), xi., 325 (1913).

♂ 16 mm. Head orange; face whitish-ochreous. Palpi orange, base and upper edge white. Antennæ grey; in ♂ thickened and with minute ciliations. Thorax orange with three whitish-ochreous spots on each side. Abdomen ochreous, bases of segments fuscous 5th to 8th segments with broad basal fuscous bands. Legs orange-ochreous, ventral aspect whitish; tarsi brownish-ochreous annulated with white. Forewings rather broadly triangular. costa gently arched, apex rounded, termen slightly bowed, moderately oblique; orange partly brownish-tinged; a whitish-ochreous spot on base, connected with a spot just beyond, and this again with an irregular spot resting on  $\frac{1}{2}$  dorsum; three steely metallic streaks between this spot and costa, and a similar dot on  $\frac{1}{2}$  dorsum; an elevated ridge of similar metallic scales from  $\frac{1}{4}$  costa to  $\frac{1}{2}$  dorsum; a squarish whitish-ochreous subcostal spot beyond this; a broken series of raised metallic dots from mid-costa to  $\frac{3}{4}$  dorsum; a whitish-ochreous subcostal dot at  $\frac{3}{4}$ ; a line of raised metallic dots from  $\frac{1}{4}$  costa angulated outwards in disc, joining previous line on dorsum; two elongate subterminal whitish-ochreous spots interrupting a sub-

terminal line of metallic dots : cilia orange, apices paler, on tornus grey. Hindwings with termen gently rounded : fuscous ; terminal edge and cilia pale orange-ochreous.

N.Q.. Kuranda, near Cairns, in March ; one specimen received from Mr. F. P. Dodd

*HELIOTHELA DIDYMOSPILA, n. sp.*

*διδυμοσπιλος*, twin-spotted.

♂ 10-11 mm. Head blackish. Palpi blackish, towards base beneath sharply white. Antennæ blackish ; in ♂ thickened and slightly laminate with very short ciliations. Thorax blackish. Abdomen blackish ; apices of first and third segments whitish. Legs dark-fuscous irrorated, and tarsi annulated with whitish. Forewings narrowly triangular, costa first straight then gently arched towards apex, apex rounded, termen obliquely rounded ; blackish ; a broad whitish line from  $\frac{2}{3}$  costa reaching half across disc ; cilia dark-fuscous, on apex with apices sometimes white. Hindwings with termen rounded ; blackish ; an oval orange-ochreous spot near base nearly reaching dorsum ; a similar spot in disc rather to the costal side of middle ; cilia dark fuscous.

Type in Coll. Turner.

N.Q., Herberton, in February. Q., Brisbane ; Stradbroke Island in December and January. This little species appears to be scarce, for though I have known it for many years, I have only four examples.

*HELIOTHELA OREIAS, n. sp.*

*ὄρειας*, daughter of the mountain.

♂ ♀ 15<sup>♂</sup>-17 mm. Head blackish. Palpi with a fairly long dense tuft on apex of second joint beneath ; blackish, bases of second and third joints white. Maxillary palpi blackish with three slender white rings. Antennæ blackish ; ciliations in ♂ minute. Thorax dark-fuscous. Abdomen dark-fuscous with some ochreous irroration on sides, apices of segments whitish. Legs dark-fuscous irrorated, and tarsi annulated with whitish. Forewings narrowly triangular, costa straight or slightly sinuate, apex round, termen obliquely rounded ; dark-fuscous with obscure

blackish lines; first from  $\frac{1}{4}$  costa slightly bent in disc to  $\frac{1}{2}$  dorsum, and followed by a blackish subcostal dot; second similar but more obscure from  $\frac{2}{3}$  costa, rather strongly bent inwards in disc, and bent again to  $\frac{2}{3}$  dorsum: between upper bend and costa is a short straight transverse mark; a third line shortly posterior and parallel to second, not reaching dorsum; space between second and third lines irrorated with white from costa to mid-disc: a few white scales on termen; cilia dark-fuscous. Hindwings with termen rounded; bright orange; basal hairs, a line along dorsum, a discal spot, and a broad terminal band narrowed in middle, blackish; cilia dark-fuscous, towards tornus paler with whitish apices.

This mountain species may be distinguished from *H. ophideres* by the blackish dorsum of hindwings, from *H. paracentra* by the absence of a white mark on dorsum of forewings, and from both by the tufted palpi.

Type in Coll. Lyell.

V., Mount St. Bernard, in January and February: four specimens received from Mr. Geo. Lyell.

#### ECLIPSIODES ACROCAPNA, *n. sp.*

*ἀκροκαπνός*, with smoky apex.

♂ 18 mm. Head dark-fuscous mixed with whitish on crown. Palpi dark-fuscous, beneath whitish towards base. Antennæ fuscous; ciliations in ♂ minute. Thorax dark-fuscous. Abdomen dark-fuscous, bases of segments whitish-ochreous. Legs dark-fuscous irrorated, and tarsi annulated with whitish-ochreous; posterior pair mostly whitish-ochreous. Forewings triangular, costa gently arched, apex rounded, termen obliquely rounded; whitish-ochreous much suffused with dark-fuscous; a dentate dark-fuscous transverse line from  $\frac{1}{4}$  costa to  $\frac{1}{3}$  dorsum; a dark-fuscous median subcostal annulus; a dentate dark-fuscous line from  $\frac{2}{3}$  costa bent inwards in disc and again downwards to dorsum beyond middle; this is outlined posteriorly by a whitish line, beyond which terminal area is broadly infuscated; a terminal series of dark-fuscous spots; cilia dark-fuscous, apices whitish. Hindwings with termen slightly rounded; whitish-ochreous with a very

broad dark-fuscous terminal band; cilia fuscous, apices whitish-ochreous.

Type in Coll. Turner.

Q., Gayndah; one specimen received from Dr. Hamilton Kenny.

*SCOPARIA EMMETROPIS*, *n. sp.*

*ἔμμετροπις*, precise.

♂ ♀ 20-22 mm. Head fuscous with some white scales. Palpi  $2\frac{1}{2}$ , tufts on second and third joints slightly separate; fuscous with some white scales, base white. Antennæ grey; ciliations in ♂  $\frac{1}{4}$ . Thorax fuscous. Abdomen grey. Legs whitish irrorated with dark-fuscous; anterio. pair mostly dark-fuscous; all tarsi dark-fuscous with whitish annulations. Forewings elongate-triangular, costa gently arched, apex rounded, termen rounded, slightly oblique; whitish irrorated with pale-grey and with a few scattered dark-fuscous scales; markings blackish; a short streak from base of costa along fold; first line dentate, oblique, from  $\frac{1}{2}$  costa to  $\frac{1}{4}$  dorsum; orbicular distinct, pale centred, touching first line; claviform dot-like, just beyond first line; reniform 8-shaped with two pale centres, but lower edge obsolete, connected with a dot on costa beyond middle; second line from  $\frac{1}{2}$  costa, angled obtusely above middle, very slightly dentate, ending on  $\frac{3}{4}$  dorsum; a suffused dark-fuscous subapical spot, and another on mid-termen; cilia whitish, bases barred with fuscous. Hindwings  $1\frac{1}{2}$ ; grey-whitish: indications of a subterminal grey line; cilia whitish.

Characterised by the uniform groundcolour, dark lines, and distinct markings. The palpi approximate to those of *Tetraprosopus*.

Type in Coll. Turner.

N.S.W., Mount Kosciusko (5,000ft.), in January; three specimens.

*SCOPARIA OCHROPHARA*, *n. sp.*

*ὠχροφαρος*, pale-rcbed.

♀ 22 mm. Head grey. Palpi 3; fuscous, base sharply white. Antennæ grey. Thorax grey. Abdomen

grey-whitish. Legs whitish with some grey irroration; anterior and middle tarsi fuscous with whitish annulations. Forewings narrow, elongate, costa moderately and evenly arched, apex rounded, termen straight, oblique; pale-grey irrorated with white and with a few scattered blackish scales; a short fine blackish streak from base; first line obsolete, indicated only by a few blackish scales; orbicular indicated by a short longitudinal blackish streak touching first line; claviform by a few blackish scales just beyond first line; reniform by a short blackish streak with some blackish suffusion on its costal edge; second line distinct, whitish, anteriorly dark-edged, slightly dentate, from  $\frac{2}{4}$  costa obliquely outwards, then obtusely bent above middle of disc, and ending on  $\frac{3}{8}$  dorsum: some blackish streaks on veins towards termen; cilia white, bases barred with grey. Hindwings 2: whitish, thinly scaled; cilia whitish.

Distinguished by the pale forewings with orbicular and reniform reduced to streaks, and the whitish hindwings.

Type in Coll. Turner.

N.S.W., Mount Kosciusko (3,500ft.), in March; two specimens.

#### Fam. ZEUZERIDÆ.

##### ZEUZERA ÆGLOSPILA, n. sp.

*αἰγλοσπίλος*, lustrous-spotted.

♂ 45 mm., ♀ 80 mm. Head whitish; face blackish. Antennæ whitish, apical half blackish; in ♂ with long pectinations, apical half simple. Thorax whitish with thirteen dark-fuscous spots, which show greenish lustre on oblique illumination; a double median row of four spots each, two lateral rows of two each, and a median posterior spot. Abdomen whitish with median lateral, and sublateral series of spots similar to those on thorax. Legs dark-fuscous with blue and purple lustre; coxæ and basal part of femora whitish; anterior coxæ fuscous anteriorly. Forewings very elongate-triangular, costa gently and evenly arched, apex round-pointed, termen very obliquely rounded; whitish, thinly scaled, semi-translucent with numerous dark-fuscous or blackish spots, with greenish or purple lustre; a row on costa, the last spot before apex larger; three rows in cell between the

dividing veinlets; a row in each interneural space, a dorsal and a terminal row, both blackish; cilia whitish, on spots blackish and lustrous. Hindwings narrow, termen sinuate, tornus strongly produced; vein 6 from below upper angle of cell, parallel with 7; colour and cilia as forewings; a terminal series of minute spots similar to those on forewings, on tornal projection and just beyond these are fused into an elongate spot.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns; two specimens received from Mr. F. P. Dodd.

*XYLEUTES OLBIA*, n. sp.

ὀλβιος, happy.

♂ 90 mm., ♀ 135 mm. Head and palpi dark-fuscous irrorated with whitish. Antennæ whitish with dark-fuscous irroration, in ♀ dark-fuscous; pectinations in ♂ 6, dark-fuscous, apical  $\frac{2}{3}$  simple. Thorax dark-fuscous with a few whitish scales, patagia except bases densely irrorated with whitish. Abdomen dark-fuscous, apices of segments grey-whitish; apical segments and tuft grey-whitish. Legs fuscous irrorated with grey-whitish; tarsi dark-fuscous with whitish rings. Forewings elongate, not dilated, costa nearly straight, apex rounded, termen scarcely rounded, strongly oblique, dorsum sinuate; pale grey, towards apex and termen grey-whitish, markings blackish; a series of spots on basal half of costa more or less confluent; a subcostal basal blotch with irregular outline; a series of fine transverse streaks through mid-disc as far as middle; a longitudinal streak above middle third of dorsum; a network at mid-disc, connected by a thick blackish irregular streak to termen beneath apex; between this streak and termen is a network extending to tornus; cilia whitish, barred with fuscous. Hindwings with apex narrowly rounded, pointed, termen nearly straight, tornus somewhat prominent, pale grey with some fuscous irroration and a network between middle of disc and middle half of termen.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in October; two specimens received from Mr. F. P. Dodd.

XYLEUTES DICTYOSCHEMA. *n. sp.*

*δικτυοσχημος*, with netted pattern.

♂ 62 mm., ♀ 94 mm. Head, palpi, and thorax dark-fuscous. Antennæ dark-fuscous; pectinations in ♂ 5, apical  $\frac{1}{4}$  simple. Abdomen fuscous, apices of segments whitish. Legs dark-fuscous; tarsi with obscure whitish annulations. Forewings elongate-oblong, costa moderately and evenly arched, apex rounded, termen obliquely rounded, dorsum sinuate: dark-fuscous closely reticulated with blackish; some whitish irroration of costal edge, a sub-apical patch, above dorsum, and on termen; cilia fuscous mixed with whitish. Hindwings elongate, apex rounded, termen gently rounded: whitish, in ♀ grey, with dark-fuscous network on apical half; cilia as forewings.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in October: two specimens received from Mr. F. P. Dodd.

XYLEUTES LEUCOMOCHLA. *n. sp.*

*λευκομοχλος*, white-barred.

♂ 120 mm. Head fuscous mixed with white; face and palpi dark-fuscous. Antennæ ochreous-fuscous; pectinations in ♂ 6. Thorax white irrorated with fuscous, a v-shaped blackish mark, its apex anterior, surrounds a central fuscous area. Abdomen whitish, bases of segments dark-fuscous. Legs fuscous. Forewings elongate, rather narrow, costa slightly arched, apex round-pointed, termen straight, oblique: dark-fuscous with scanty whitish irroration; a broad whitish median bar from base to beyond middle; connected with apex by ill-defined broad whitish streaks, partly strigulated with dark-fuscous; cilia dark-fuscous with some whitish scales. Hindwings broader than forewings, termen somewhat sinuate; fuscous-grey, darker towards base; some whitish suffusion at apex and tornus; cilia whitish with some dark-fuscous bars.

Type in Coll. Illidge.

W.A., Cunderdin, in November; one specimen taken by Mr. R. Illidge.

## XYLEUTIS EREMONOMA.

*Xyleutis eremonoma*, Turn., Tr. R.S.S.A., 1906, p. 139.

Q., Cunnamulla. N.S.W., Brewarrina; one ♂ example received from Mr. W. W. Froggatt, who states that the larvæ feed in the roots of the "Roley Poley," the plants snapping off and blowing away through their infestation.

## Fam. HEPIALIDÆ.

## HEPIALUS ASTATHES, n. sp.

ἀσταθής, unstable.

♂ 41-44 mm. Head whitish sometimes pinkish. Palpi fuscous, internal surface whitish. Antennæ very short, ochreous-whitish. Thorax with a posterior crest; whitish, sometimes pinkish; an ill-defined transverse median greenish band. Abdomen whitish, towards apex greenish or pinkish. Legs ochreous-whitish or pinkish. Forewings triangular, costa strongly sinuate, apex acute, termen sinuate, oblique; pale green, or pinkish with or without greenish suffusion, some irregular darker striæ; a whitish streak on basal  $\frac{2}{3}$  of costa; a slender whitish streak from mid-disc at  $\frac{1}{3}$  towards but not reaching dorsum beyond middle, then curved and continued parallel to termen to  $\frac{3}{4}$  costa; cilia whitish. Hindwings with termen sinuate; white; tinged with greenish or pinkish at tornus: cilia whitish.

♀ 46-72 mm. Forewings fuscous-reddish; a large triangular green blotch beneath costa from  $\frac{1}{3}$  to  $\frac{3}{4}$ , its rounded lower angle approximating to mid-dorsum; a broad green terminal band not reaching tornus, sometimes with a projection on its anterior border in mid-disc; cilia fuscous-reddish. Hindwings with termen sinuate; pale red: some fuscous suffusion at tornus; cilia reddish.

Allied to *H. lignivorus*; the females of the two species are hardly distinguishable. The males are very distinct in the discal curved line, which in *astathes* is more like that of *lewinii*. The colouration of the ♂ varies much.

Type in Coll. Illidge.

W.A., Albany and Waroona; larvæ taken by Mr. R. Illidge emerged in February.

HEPIALUS TEPHROPTILUS, *n. sp.**τεφροπιλος*, ashy-winged.

♀ 112 mm. Head and palpi green. Antennæ ochreous-whitish. Thorax grey, anteriorly greenish-tinged. Abdomen whitish-ochreous, dorsum fuscous except three basal segments, and bases of other segments. Legs whitish-ochreous, greenish-tinged; tarsi grey. Forewings broadly triangular, costa nearly straight, arched towards apex, apex round-pointed, termen straight, oblique, rounded towards tornus; grey, at base and along costa greenish; several triangular whitish spots in basal half; a straight interrupted narrow whitish band from  $\frac{1}{4}$  costa towards but not reaching mid-dorsum; a fainter similar band midway between this and termen; cilia grey. Hindwings broad, termen strongly rounded; grey; cilia grey.

Type in Coll. Illidge.

W.A., Albany; one specimen, which emerged in March, from a larva obtained by Mr. R. Illidge.

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## NOTES ON AN EXHIBIT OF SPECIMENS OF CERATODUS

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DR. T. HARVEY JOHNSTON AND DR. T. L. BANCROFT.

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(Before the Royal Society of Queensland, May 31st, 1915.)

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DR. T. HARVEY JOHNSTON exhibited a series of specimens of *Neoceratodus forsteri* (Kreffft), forwarded to him by Dr. T. L. Bancroft, of Eidsvold, Burnett River.

The largest measured exactly 40 cm. (16 inches), and its weight was approximately a pound and a-half. Only one *Ceratodus* of a smaller size, a fourteen inch specimen, appears to have been taken previously.

Another of the exhibits was 75 mm. in length with a maximum dorsoventral breadth of 13.5 mm. which was in the anterior part of the tail region, the greatest breadth in the trunk reaching 13 mm. The maximum width, *i.e.*, from side to side, was in the head region and measured 10.0 mm. The dorsal fin extended relatively much further forward than in the adult, reaching to within a few millimetres of the opercular region. The opercula were much more evident than in an adult, the two meeting ventrally to form a V. whose apex was directed forwards, whereas in the adult exhibited, they were separated by a considerable interval. Each covered relatively more of the base of the corresponding pectoral fin than in an adult lung-fish. The inequality in the size of the pectoral and pelvic fin was relatively much greater than in adults, the pelvic fin being much smaller. The ratio of the length of the tail, *i.e.*, the region behind the anus, to the rest of the body was nearly the same as in the case of an adult, being 5 : 6 and 5.27 : 6 respectively.

This specimen was just seven months old and had been reared, along with a few others, from the egg stage by Dr. Bancroft. It was killed to serve as a record of the work, the remaining fish being still alive. Pelvic fins were distinctly visible to the naked eye when the fish were two and a-quarter inches long and about six and a-half months old.

The third exhibit was a very young *Ceratodus*, six weeks old (*i.e.*, after hatching), and measuring 17 mm. in length, the tail being only a little over one third of the total length of the animal. It possessed very simple pectoral fins, but there was no trace of the pelvics. The specimen showed a distinct advance in development on the four-weeks-old larva figured by Semon.

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## HERPETOLOGICAL NOTES.

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By DENE B. FRY,

Australian Museum, Sydney.

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(Plates I—IV, text-figures 1—7.)

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(Read before the Royal Society of Queensland, May 31st  
and June 28th, 1915.)

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THE present paper consists of notes on, and descriptions and redescriptions of, new or little known Reptiles and Batrachians from Australia and New Guinea, based mainly on specimens in the collection of the Australian Museum. The 'notes' mostly consist of additions to the faunæ of the different States of Australia and New Guinea, together with remarks on affinities and distribution. There are four new species and two new varieties proposed.

The following species are dealt with:—

*Austrochaperina brevipes*, sp. nov.

*Limnodynastes tasmaniensis*, Gthr.

„ *platycephalus*, Gthr.

„ *fletcheri*, Blgr.

„ *olivaceus*, de Vis.

„ *dorsalis*, v. *terræ-reginæ* var. nov.

*Phanerotis fletcheri*, Blgr.

*Phractops brevipalmatus*, Gthr.

*Philocryphus australiacus*, Shaw.

*Lechriodus melanopyga*, Doria.

*Hyla macgregori*, Ogilby.

„ *ewingii* v. *alpina*, var. nov.

„ „ v. *calliscelis*, Ptrs.

„ *lesueurii* v. *vinosa*, Lamb.

*Ædura monilis*, de Vis.

*Calotes cristatellus*, Kuhl.

*Gonyocephalus spinipes*, A. Dum.

*Chelodina intergularis*, sp. nov.

*Pseudelaps christieanus*, sp. nov.

„ *minutus*, sp. nov.

# i. NOTES ON, AND DESCRIPTIONS OF NEW OR LITTLE KNOWN AUSTRALIAN AND PAPUASIAN FROGS.

## 1. AUSTROCHAPERINA BREVIPES, sp. nov.

*Austrochaperina robusta* (part), Fry, Rec. Austr. Mus.,  
ix, 1912, p. 89, pl. viii, fig. 2-2b.

Habit very stout. Head two-thirds as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rounded, very slightly prominent, shorter than the orbital diameter. Nostril much nearer the tip of the snout than the eye. Canthus rostralis moderately rounded; loreal region slightly concave. Interorbital space broader than the upper eye-lid. Tympanum rather distinct, slightly less than half the diameter of the eye. Lower jaw rounded, tri-lobed. Tongue very large, oval, entire, free right along the sides and for about half its length posteriorly. Two dermal æsophageal ridges; anterior very weak although nearly as extensive as the posterior, with a well developed median lobe and papillose laterally; posterior ridge extending right across the hinder palate and strongly and evenly serrated. Arms weak. Fingers depressed; discs distinct but not enlarged; a thick fringe present; first nearly as long as second, cylindrical and not disced; an indistinct metacarpal pad on the base of the first finger. Hind limb very stout. Toes rather short, depressed; third, fourth and fifth with a distinct rather thick fringe; discs larger than the finger discs. A very small oval inner metatarsal tubercle. The length of the outstretched hind-limb, from the anus to the tibio-tarsal articulation, equals the distance between the anus and the shoulder.

*Colour (spirits)*:—Upper-surfaces uniform fawn brown, spotted and speckled with chocolate brown. A dark streak

from the tip of the snout through the eye to the shoulder. Under-surfaces uniform creamish.

Total length of type . . . . . 28.5 mm

*Localities*:—One specimen from the Bloomfield River, near Cooktown, North-eastern Queensland, collected by Mr. Geo. Hislop, in 1897.

The specimen on which this new species is founded was regarded in my original description of *Austrochaperina robusta*\* as a variety of that species. It was placed in var. B. of *A. robusta*, a variety which may still be distinguished amongst the collection of type specimens by the absence of a thread-like dorsal stripe. *A. brevipes* is distinguished from *A. robusta* by its larger size, the type of the latter being only 23mm. in length, its broader head, its much shorter and stouter hind-limbs, and the more accentuated markings. The colouration of the type of *A. brevipes*, after 17 years immersion in spirits, resembles markedly that of *Chaperina polysticta* as shown by von M  hely's† figure. However, in that species the spots are rather fewer and larger than in my new *Austrochaperina*.

I have examined the sternal apparatus of *A. brevipes* and find that it differs from *A. robusta* in the greater development of the procoracoid cartilage, showing a condition intermediate between the latter and *Chaperina punctata*, v. Kampen,‡ for a specimen of which I am indebted to the author.

## 2. LIMNODYNASTES TASMANIENSIS, Gthr.

*Limnodynastes tasmaniensis*, (Gthr.) Boulenger, Brit. Mus. Cat. Batr., 1882, p. 260. *Id.*, Fletcher, Proc. Linn. Soc., N.S.W. (2), iv, 1889, pp. 365 and 374. *Id.*, Fletcher, *loc. cit.*, v, pp. 667-676. *Id.*, Fletcher, *loc. cit.*, vi, 1891, p. 271. *Id.*, Fletcher, *loc. cit.*, vii, pp. 7-18 (*L. fletcheri*, Blgr., a var. of *L. tasmaniensis*). *Id.*, Fletcher, *loc. cit.*, xxii, 1898, p. 662. *Id.*, Lucas and le Souef, Anim. Austr., 1909, p. 269. figs. *Id.*, English, Proc. Zool. Soc., 1910, p. 268, pl. li, figs. 1-2.

\* Fry—Rec. Austr. Mus., ix, 1912, p. 89.

† M  hely—Term  s. F  zeteck, xxiv, 1901, pl. xii.

‡ Van Kampen—Nova Guine  , ix, 1913, p. 463, pl. xi, fig. 7.

There is a reason to doubt Gerard Krefft's record\* of this species from South Australia, for it is probable that the specimens were those afterwards described by Dr. Gunther as *L. platycephalus*. The only other record is that of Peters.† This record is substantiated by a specimen forwarded recently to the trustees by Miss A. M. Sharply from Narracoorte, a township near the Victorian border in South Australia.

In this specimen there is no trace of an outer metatarsal tubercle so distinct in *L. platycephalus*, although it sometimes does occur in Eastern Australian examples. The toes are normally fringed, and the width of the head is normal. Whether *L. platycephalus* is distinct or not, there can be no doubt that the true *L. tasmaniensis* shares with it or lives closely approximated to its habitat.

### 3. LIMNODYNASTES PLATYCEPHALUS. Gthr.

*Limnodynastes platycephalus* (Gthr.) Boulenger, Brit. Mus. Cat. Batr., 1882, p. 260, pl. xvii, fig. 3.

Redescription of *Limnodynastes platycephalus*, Gthr.

Habit moderate. Head, three-quarters as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana; very depressed. Snout bluntly rounded, not prominent, less than the diameter of the eye; nostril much nearer the tip of the snout than the eye; canthus rostralis rounded, loreal region with a concavity in the form of a narrow groove. The outline of the tympanum is very slightly visible, about half the diameter of the eye. Interorbital space considerably broader than the upper eye-lid. Vomerine teeth in two long contiguous series, perfectly transverse and not arched, behind, and extending beyond the outer edge of the widely separated choanæ. Tongue sub-circular, entire. Skin smooth with very obscure flat warts; no fold above the tympanum, but a glandular thickening along the side; a yellowish gland from below the eye past the angle of the mouth; under-surfaces smooth

\* Krefft:—Cat. Industr. Nat. Prod., N.S.W., Paris Exhib., 1867, App., p. 107.

† Mon. Berl. Ac. 1863.

except for some small whitish granules on the hinder side of the thighs. Limbs moderate. Fingers with a slight fringe, the first shorter than the second; sub-articular tubercles distinct but not prominent; three well developed metacarpal tubercles, one at the base of the first finger. Toes with a slight fringe and the merest indication of a web between their bases; sub-articular tubercles prominent; a small oval inner and a distinct round outer metatarsal tubercle. The distance between the anus and the tibio-tarsal-articulation equals the distance between the latter and the tympanum.

*Colour (Spirits)* :—Dark-grey above, speckled, spotted and marbled with darker. An indication of an interrupted light dorsal stripe. A black streak along the canthus; lips spotted; sub-orbital gland a yellow streak. Shank spotted but not barred. Under-surfaces yellowish to brownish; throat grey. Sides, thighs, and shank with brownish freckles.

Measurements in Millimetres.

|   |    |    |        |
|---|----|----|--------|
| Length of head to tympana                     | .. | .. | 12 mm. |
| Width of head at tympana                      | .. | .. | 16 mm. |
| Length of hind limb, anus to tarso-metat-art. |    |    | 40 mm. |
| Total length, anus to tip of snout            | .. |    | 40 mm. |

*Loc.* :—One specimen from Wilcannia, Darling River, Western New South Wales, collected by R. Helms in 1890.

At present there appear to be only three specimens of this species known. These certainly warrant our recognising it as distinct from its ally, *L. tasmaniensis*. The distinguishing characters are the most extensive vomerine teeth, which extend outwards well beyond the choanæ, the broader head, and to a lesser extent, the disposition and nature of the colour markings. Several other differences noted may be due to individuality, but we require further specimens to prove this. The species has arisen at the western limit of *L. tasmaniensis*, and its presence on the Darling River in Western New South Wales proves that it has followed the watercourses northward in that state. Although it is here found in company with *L. fletcheri*, I regard the latter as having arisen after isolation from the true Eastern *L. tasmaniensis*, either (1) after crossing the Dividing Range or entering Western

New South Wales by way of the upper reaches of the Murray River from Gippsland, or (2), after crossing the low watershed of Southern Queensland.

#### 4. LIMNODYNASTES FLETCHERI, Blgr.

*Limnodynastes fletcheri*, Boulenger, A.M.N.H., (6), ii, 1888, p. 142. *Id.*, Fletcher, Proc. Linn. Soc., N.S.W., (2), v, 1890, pp. 672 and 675.

*Limnodynastes tasmaniensis* (Gthr.) var. (?) Fletcher, *loc. cit.*, vii, 1892, pp. 16-18. *Id.*, Fletcher, *loc. cit.*, viii, 1894, p. 529.

*Limnodynastes marmoratus*, Lamb, Ann. Q'land. Mus., No. 10, 1911, p. 28. *Id.*, Fry, Rec. Austr. Mus., ix, 1912, pp. 98 and 106. (= *L. fletcheri*.)

There are seven examples of this species in the Museum collection taken by Mr. Robt. Helms, at Wilcannia, Darling River, Western New South Wales. Besides these, are two unlocalised examples and a co-type specimen of Lamb's *L. marmoratus*. The latter agrees well with the Western New South Wales examples.

*Limnodynastes fletcheri* is a larger and stouter species than *L. tasmaniensis* and may be distinguished by the following characters:—The toes are very much more pointed and fringed and have a prominent basal web. (This was suggested by Mr. Fletcher, who forwarded the types to Dr. Boulenger, to be possibly due to immersion in too strong a preserving fluid, but my specimens dispel all doubt and show that the condition is natural). The skin is rough and glandular. The markings on the back consist of coarse marmorations of dark brown (sometimes grey) with noticeable suffusions of bright carmine or pink, most pronounced on the eyelids. There is always only one metatarsal tubercle, an outer.

#### 5. LIMNODYNASTES OLIVACEUS, de Vis.

*Limnodynastes olivaceus*, de Vis, Proc. Linn. Soc., N.S.W., ix, 1884, p. 66. *Id.*, Boulenger, A.M.N.H., (5), xvi, 1885, p. 387.

Re-description of *Limnodynastes olivaceus*, de Vis.

Habit moderate. Head three-quarters to four-fifths as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rather prominent and pointed when seen from above, longer than the orbital diameter; nostril equidistant between the eye and the tip of the snout; canthus rostralis very rounded; loreal region grooved. Tympanum hardly discernible or completely hidden. Interorbital space as broad as the upper eye-lid. Tongue large, oval or sub-circular, entire, free behind and a little on the sides. Vomerine teeth in two long straight or slightly arched series behind, and extending well beyond the outer edge of the choana. Limbs moderate. Fingers free, cylindrical, not fringed, first as long as second; sub-articular tubercles very prominent; two outer metacarpal tubercles and a third large one at the base of the first finger. Toes cylindrical, tapering, quite free; sub-articular tubercles very prominent, conical; a conical outer, but no inner metatarsal tubercle. Skin warty; sometimes with short plicæ; sometimes the warts are large oval and raised, or round and flat, but always profusely present (they are often exactly covered by a dark spot). A weak gland from below the eye to above the forearm. Sides with a distinct fold; no fold across the chest or along the inner edge of the tarsus. Under-surfaces uniformly smooth. The distance between the anus and the tibio-tarsal articulation is equal to the distance between the latter and the tympanum.

*Colour (spirits)*:—Uniform greyish above (perhaps olive in life) with numerous roundish black spots, which sometimes form more or less broken bands of which a broad dorsal one—commencing between the eye-lids, and a lateral one can usually be traced. Upper-surface of snout usually with a light triangular mark. No dorsal stripe. Lips barred or spotted. Limbs spotted. Under surfaces uniform white or with a few spots of grey on the chin.

Measurements in Millimetres.

|   |       |        |
|---|-------|--------|
| Total length, from tip of snout to anus     | ..    | 45 mm. |
| Length of head, to tympana                  | .. .. | 14 mm. |
| Width of head, at tympana                   | .. .. | 18 mm. |
| Length of hind-limb to tarso-metat-articul. |       | 40 mm. |

*Locs.*:—Four specimens from Mapoon, Gulf of Carpentaria, North Queensland, collected by Mr. Charles

Hedley. There are also two unlocalised specimens and one from Herbert River, North-east Queensland.

*L. olivaceus* differs from *L. tasmaniensis* which it replaces on the north and central coast of Queensland, by the following characters:—The toes are cylindrical, generally devoid of a basal web or any trace of fringe; the sub-articular tubercles are very prominent and conical; only one metatarsal tubercle always; the back has prominent warts; the snout is more pointed; and more or less by the broken up nature of the markings of the back, and their tendency to distribution in characteristic bands.

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The four species of *Limnodynastes* so far noticed, e.g., *L. tasmaniensis*, *platycephalus*, *fletcheri*, and *olivaceus*, form a natural group more or less distinct from the rest of the genus. They are closely allied to each other, and it becomes a question whether we should regard them as distinct species or as geographical varieties of one, *L. tasmaniensis*. Of all but *L. platycephalus* I have examined a series of specimens, but of that species I have only seen one. This, however, certainly supports its separation from *L. tasmaniensis*. The distinguishing characters of the four species are of relative value, and although to an extent variable, do not merge completely with one another. The habitat of each, with the exception of *L. platycephalus*, is distinct. While at present their validity as species is perhaps a matter of opinion, I am inclined to believe that they are correctly regarded as such.

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6. *LIMNODYNASTES DORSALIS*, var. *TERRE-REGINÆ*, var. *nov.*

(Text fig. 2a, sacral verteb.)

*L. dorsalis*, v. *dumerilii*, Ptrs. (part), Fry, Rec. Austr. Mus., x, 1913, pp. 26-28, 30, pl. iii, fig. 2.

A variety proposed for north and central coastal Queensland examples, differing from *L. dorsalis* v. *dumerilii* confined to South Australia, Victoria, Tasmania, New South Wales and Southern Queensland, in the following characters:—The habit is excessively stout and the size very large; the hind-limb is very short being 1.1 to 1.25

in the total length; the head is usually broader, but occasional New South Wales specimens are found with just as broad heads; vomerine teeth very strong, always extending well beyond the outer edge of the choanæ; toes short and cylindrical, *usually devoid of fringe*; in far northern examples the spots are disposed in well marked bands and a light dorsal stripe may be present; under-surfaces often with light red suffusions.

| SPECIMEN No.                          | 1           | 2         |
|---------------------------------------|-------------|-----------|
| From snout to vent .. .. .            | mm.<br>79.5 | mm.<br>78 |
| Head, to level of tympana .. .. .     | 24          | 22        |
| Width of head at tympana .. .. .      | 37.5        | 36        |
| Hind-limb, anus to tip of toe .. .. . | 87          | 100       |

Specimen No. 1 from Cape York (one of the types)

Specimen No. 2 from Burnett River. Shows how the hind-limb lengthens as we go south. The other characters, too, show a gradual passing into the southern variety.

*Type*:—In the Australian Museum, Sydney. Reg. No. R.4525.

*Loc.*:—Somerset, Cape York, N. Queensland, collected by Messrs. Hedley and McCulloch in 1907.

Since writing the paper referred to above on the varieties of *L. dorsalis*, Gray, it has become evident that the characters noted on p. 30 of some Cape York examples are to a great extent constant throughout specimens as far south as the Burnett River in Queensland. The inclusion of these specimens in var. *dumerilii* makes that variety so comprehensive that I think it best to separate off this distinct form as a separate variety. The var. *terræ-reginæ* then, will stand for all specimens from the area north of the Burnett River, including the district drained by the river itself. At some locality south of the Burnett River and probably north of the Brisbane River, this new variety blends with var. *dumerilii*, for specimens from Brisbane possess the characters of the latter.

## 7. PHANEROTIS FLETCHERI, Blgr.

(Pl. I, fig. 2, mouth only. Text fig. 1.)

*Phanerotis fletcheri*, Boulenger, Proc. Linn. Soc. N.S.W., (2), v, 1890, p. 593. *Id.*, Fletcher, Proc. Linn. Soc., N.S.W., (2), v, 1890, p. 669. *Id.*, Fry. Mem. Q'land Mus., ii, 1913, p. 47.

The types of this rare frog were taken at Dunoon, Richmond River, north coast of New South Wales, by Richard Helms, in 1890. In the Australian Museum collection is a single adult specimen collected by the late J. A. Thorpe, in the year 1886, at Ourimbah, near Gosford, N.S. Wales. Ourimbah is about forty miles north of Sydney and is the southern termination of a stretch of "Dorrigo Scrub" country possessing the same geological and botanical features as that in which the types were procured. Its range is thus extended about two-hundred miles southwards.

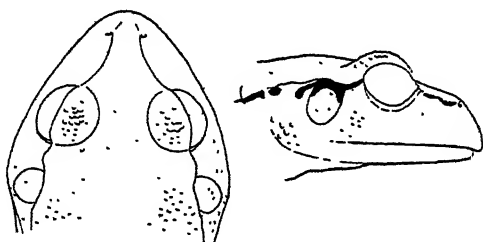


Fig. 1.—*Phanerotis fletcheri*, Blgr. Superior and lateral view of head of a specimen from Ourimbah, N.S. Wales. Slightly enlarged.

This specimen differs slightly from the types as follows:—In transverse diameter the tympanum is two-thirds the eye, perpendicularly it is four-fifths; the  $\wedge$ -shaped fold between the shoulders is absent. The colouration is here described in detail:—Upper-surface of body and limbs greyish green to putty colour, with obscure faint blotches of darker grey on the back; a fairly distinct dark cross-bar between the eye-lids; sides of head with faint marks, one of which runs from the eye to the lip; a thin, broken rostral streak of chocolate-brown which continues from behind the eye to the posterior edge of the tympanum, where it breaks into a few disconnected spots on the shoulder: front, hinder and under-surfaces of limbs reddish-brown

with small grey spots; lower-surfaces of body yellowish, the gular region with faint brown spots; with the exception of the sides of the body the colour of the upper and lower surfaces shows a sharp line of demarcation; the limbs bear indistinct cross-bars.

#### 8. PHRACTOPS BREVIPALMATUS, Gthr.

*Chiroleptes brevipalmatus*, (Gthr.), Boulenger, Brit. Mus. Cat. Batr., 1882, p. 269, pl. xvii, fig. 5. *Id.*, Spencer, Rep. "Horn." Sci. Expd., 1896, p. 165. *Id.*, Fletcher, Proc. Linn. Soc., N.S.W., xxii, 1898, pp. 678 and 682. *Id.*, Lucas and le Souef, Anim. Austr., 1909, p. 277.

This species is known from the following localities:—Port Denison, Cape York, Gayndah and Peak Downs, in Queensland (Boulenger, 1882), Central Australia (Spencer, 1896), King's Sound, Fitzroy River, and Margaret Creek in Western Australia (Fletcher, 1898). It does not, however, appear to have been recorded from New South Wales, but in the Museum collection are eighty well preserved specimens from Wilcannia on the Darling River, in the far west of that State.

#### 9. PHILOCRYPHUS AUSTRALIACUS, Shaw.

*Rana australiaca*, Shaw, Nat. Misc., vi, 1795, pl. 200, and text. *Id.*, Andersson, Kungl. Sv. Ak. Handl., Bd. 52, 1913, p. 3.

*Rana spinipes*, Schneider, Hist. Amphi. i, 1799, pp. 129 and 139. *Id.*, Shaw, Gen. Zool., iii, i, 1802, p. 112. *Id.*, Andersson, *loc. cit.*

*Heleioporus albopunctatus*, Gray? Fletcher, Proc. Linn. Soc., N.S.W., (2), v, 1890, p. 671.

*Philocryphus flavoguttatus*, Fletcher, *loc. cit.* (2), viii, 1894, p. 233. *Id.*, Lucas and le Souef, Anim. Austr., 1909, p. 282, fig. *Id.*, Steel, Austr. Nat., ii, 1912, p. 135, (habits). *Id.*, Fry, Rec. W. Austr. Mus., i, 1914, p. 205, figs. 8a and 9.

Whilst recently referring to Shaw's "Naturalists' Miscellany" (1795) I was struck with the resemblance between the frog figured on plate two-hundred as *Rana*

*australiaca* and that described a century later by Mr. J. J. Fletcher as *Philocryphus flavoguttatus*. In comparison to recent figures Shaw's figure is of course very crude, but it permits of identification just as well as the figures of *Rana cærulea*, *Coluber porphyriacus*, etc., which form the basis of present recognised species. As will be shown later the two frogs are almost certainly identical, so that no course is open but to replace Fletcher's well founded name. This is to be regretted, for *Rana australiaca* was founded on a drawing sent to Dr. Shaw from New Holland and no specimen type exists, while the types of *Philocryphus* are beautifully preserved specimens in Mr. Fletcher's private collection.

As Shaw's work (Nat. Misc.) is rare and not easily accessible the concise description and remarks are here given in toto:—

## RANA AUSTRALIACA.

### Character Genericus.

*Corpus* tetrapodum, ecaudatum, nudum.

Linn. *Syst. Nat.*, p. 354.

### Character Specificus.

RANA FUSCA, subtus cærulescens, lateribus gilvo punctatis, digitis anterioribus spinosis.

On the following page, not numbered, facing plate 200, Dr. Shaw remarks:—

“This animal certainly cannot be numbered amongst the most beautiful of its genus: it is a species, however, which has never before been described, and is more particularly interesting from the circumstances of its being a native of the distant regions of New Holland, which has added so many zoological treasures to the cabinets of natural history. Its rarity must, therefore, apologise for its deformity.”

In General Zoology (1802), Shaw gives a useful reference and some supplementary remarks as follows :—

“*Rana Australiaca*. Australian Frog. *Naturalists' Miscellany*, vol. 6, pl. 200.

*Rana spinipes*. *Schneid. Amph.*, p. 129-139.

“This was first described in the *Naturalists' Miscellany*; and so careful has Mr. Schneider been to preserve it from oblivion, that he has twice described it in his own work within the compass of a few pages. He is mistaken, however, in supposing it to exist in the British Museum; the figure having been etched from a drawing made in New Holland, its native country. Its size appears to be somewhat larger than that of the common European Frog, and its habit approaches rather to that of a toad, or a Natter-Jack, which latter it seems to resemble in its manner of walking, viz., with the limbs elevated, or in the manner of the generality of quadrupeds. All the feet are unwebbed.”

There are only two Australian frogs which could reasonably be compared with *Rana australiaca*, Shaw, namely, *Philocryphus flavoguttatus*, Fletcher, and *Limnodynastes dorsalis*, Gray (eastern form, var. *dumerilii*, Ptrs.). The “spines” on the hands, which, no doubt, prompted Schneider to rename the species “*spinipes*,” are secondary sexual characters developed only in males, and are of course seasonal. It is this character which prevents us further considering it with *Limnodynastes dorsalis*. In that frog, as in *Hyla aurea*, Lesson, the nuptial excrescence is in the form of a flat, horny, brown plate on the inner side of the first finger, spines being quite absent. The distribution of these spines in Shaw's figure is not exactly as shown by my specimens of *Philocryphus*, but gives a general representation. The tympanum is figured as hidden. As in the case of the spines this must not be seriously considered. Even though the tympanum of *Philocryphus* is described as ‘distinct,’ it is nevertheless not obvious and may easily have escaped notice by a colonial artist, or if indicated by him, not reproduced in Shaw's etching. Such a character did not then have the

significance it has to-day, and the obscure tympanic rim and undifferentiated colouration makes it easy to understand its absence in the figure, which undoubtedly gives a striking, if a little impressionistic, representation of this ungainly frog. The colouration resembles closely one of my specimens. In *L. dorsalis* there is a yellowish glandular band laterally, but the row of spots figured are typically those of *Philocryphus*, giving the suggestion for Fletcher's specific name *flavoguttatus*. Hence I regard *P. flavoguttatus*, described in 1894, as identical with *Rana australiaca*, described a century earlier. As has been shown\* recently *Philocryphus* is not, as afterwards supposed by Fletcher, synonymous with *Heleioporus*, therefore the name will be altered to *Philocryphus australiacus*.

The disappearance of a well figured, named, and localised frog from literature is unaccountable. L. G. Andersson recently called (see syn.) attention to the fact that the name *Rana australiaca* had disappeared from literature subsequent to the mention by Schneider in 1799 and Shaw in 1802. After examining the works of Daudin, Cuvier and Merrem, he says that "but a single Australian species is recorded, viz., White's *Rana (Hyla) cœrulea*." He also suggests the likelihood of Shaw's locality being erroneous, suggesting that perhaps the frog really came from the East Indies and not New Holland, in which case it would probably prove identical with *Bufo melanostictus*. We have no need to assume this, however.

#### 10. LECHRIODUS MELANOPYGA, Doria.

(Plate I, fig. 1, Text fig. 2c.)

*Asterophrys melanopyga*, Doria, Ann. Mus. Civ. Genov., vi, 1874, p. 355, pl. xii, fig. k. *Id.*, Ptrs. and Doria, loc. cit., xiii, 1878, p. 417.

*Batrachopsis melanopyga*, Boulenger, Brit. Mus. Cat. Batr. Sal., 1882, p. 439. *Id.*, Lucas, Proc. Linn. Soc., N.S.W., xxiii, 1898, p. 359.

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\* Fry:—Rec. W.A. Mus., I, 1914, p. 206, fig. 8a and 9.

*Lechriodus melanopyga*, Boulenger, Brit. Mus. Cat. Batr. Grad., 1882, p. 116 (footnote). *Id.*, Fry, Mem. Q'land. Mus., ii, 1913, p. 48.

There are three specimens of this frog in the Museum collection. Two were presented to the trustees by Mr. Thos. Steel, F.L.S., and are those mentioned by Lucas (see synonymy), from Fife Bay, British New Guinea. The third example was collected by the Royal Geographical Societies' Expedition of 1885, in the St. Joseph's River District, British Papua. Barbour's\* tables of distribution published in 1912, record this frog from Dutch Papua only.

Lucas notes that the "tympanum is nearly as long in vertical diameter as the eye is wide. There is no perceptible dark streak on the canthus rostralis." In my third example these differences may also be noted. All three specimens differ strikingly from Doria's figure and Boulenger's description by the broader head, the more slender habit, and longer limbs. Shrinkage due to preservation might account for the more slender habit, but the broad head and longer limbs make it difficult to believe that my specimens really belong to this species. The figure of the St. Joseph's River example will assist those more fortunately situated to determine this point.

The striking resemblance between certain Cystignathids, notably *Limnodynastes*, *Phanerotis*, and *Ranaster*,† and the Pelobatid genus *Lechriodus*, has previously‡ been referred to. So complete is the resemblance of *Phanerotis* to *Lechriodus* that it is difficult to find even specific characters with which to distinguish them. *Limnodynastes*, however, is easily separated from *Lechriodus* by its hidden tympanum, while *Ranaster* is at present only doubtfully distinct from *Phanerotis*. A striking feature in common is mentioned by Boulenger|| "in the female (of *Lechriodus*) the two inner fingers are lobate, as in many *Limnody-*

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\* Barbour—Mem. Mus. Comp. Zool. Harv., xliv, No. 1, 1902, p. 177.

† Van Kampen has shown (Nov. Guin., v, i, 1909, p. 136), that this frog, which he mentions under the name of *Phanerotis novæ-guinææ*, belongs to the Cystignathidæ.

‡ Fry—Mem. Q'land Mus., ii, 1913, p. 48.

|| Boulenger—Brit. Mus. Cat., 1882, p. 440.

*nastes*," a character which does not occur, so far as I am aware, in any other Pelobatid. As the chief difference between the Cystignathids mentioned and the Pelobatid *Lechriodus* appears to lie in the extent of dilation of the sacral vertebræ, I have figured those of two Australian genera showing close affinity, to show the fallacy of such a character for distinguishing purposes. A glance at the figure shows that a clear line of demarcation between the two families with regard to this character does not exist.

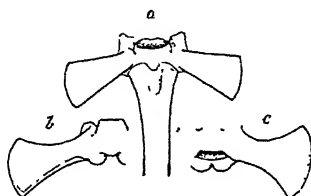


Fig. 2.—a. Sacrum of *Limnodynastes dorsalis*, Gray.

b. Sacrum of *Heleioporus albopunctatus*, Gray.

c. Sacrum of *Lechriodus melanopyga*, Doria.

The anterior edge of the neural arch and the zygopophyses of c were badly broken during dissection.

In the Neotropical genera of Cystignathidæ, true cylindrical diapophyses are an almost invariable rule, but the Australian members of this family exhibit all stages between that of *Heleioporus* with considerably dilated diapophyses and the condition shown in South American genera. In *Crinia*, an Australian genus of Cystignathidæ, the sacral diapophysis is quite cylindrical; in some *Limnodynastes* they are slightly dilated, most conspicuously so in *L. dorsalis*, here figured; in *Chiroleptes* and *Heleioporus* they are so expanded as to be nearer the condition of the Pelobatid *Lechriodus* than to the typical Cystignathidæ. I think that these Australian genera should be considered as true Cystignathids, but Boulenger's definition of the sacral diapophysis—cylindrical or slightly dilated—hardly implies their true condition if we are to regard *Lechriodus* as possessing *strongly* dilated vertebræ.

The home of the Cystignathidæ is undoubtedly South America. It appears just as certain that our Australian members of this family have arisen directly from South American stock, though showing divergent lines of specialis-

ation in several genera. *Lechriodus* is a Pelobatid of doubtful affinities (as regards other members of its family) and with *Asterophrys* exists well separated from other genera of the Pelobatidæ. Thus its affinity to the Australian Cystignathids and its propinquity of habitat point to a striking conclusion. A true Cystignathid, too, *Phanerotis* (= *Ranaster*), is now known from New Guinea.

#### 11. *HYLA MACGREGORI*, Ogilby.

(Plate II, Text figure 3.)

*Hyla macgregori*, Ogilby, Rec. Austr. Mus., i, 1890, p. 100.

*Hyla thesaurensis* (Ptrs.) v. Méhely, Term. Füzetek., xx., 1897, p. 414, pl. x, fig. 7.

Size small. Habit very slender. Head almost as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Eye large, its diameter a trifle longer than that of the snout; the latter rounded, slightly prominent; nostrils much nearer the tip of the snout than the eye; canthus rostralis very rounded; loreal region not concave. Inter-orbital region a little broader than the upper eye-lid. Tympanum very distinct, perfectly round; separated from the eye by a distance less than its diameter, which is about one-half that of the eye. Tongue oval or sub-circular, entire, sometimes with a median longitudinal groove or three small dimples; free a little behind and on the sides. Vomerine teeth always present; in two small oblique separated groups, their front edges on a level with the hinder edges of the widely distant choanæ. Skin smooth; a mere indication of a fold above the tympanum across the chest and along the inner edge of the tarsus; under-surfaces of the thighs and belly granular. Fingers with a distinct web, the deepest part of the concavity of the web between the third and fourth on a level with the proximal sub-articular tubercle; others less than one-third webbed; fringed to the discs; discs as large as the tympanum; sub-articular tubercles distinct; a number of swollen

tubercle-like pads on the palm; a metacarpal tubercle opposite the base of the first finger. Toes almost webbed to the discs except on the fourth; discs a little smaller than finger discs; sub-articular tubercles distinct; a small inner metatarsal tubercle. The distance between the anus and the tibio-tarsal articulation of the outstretched hind-limb, equals the distance between the latter and the anterior border or a little in front of the eye.

*Colour (spirits)*:—Mr. Ogilby's colour description is so excellent that it is best to quote it *verbatim*:—

“Variable, those of the two extreme forms being as follows: (a) upper-surface of head and body dark brown; the former with small yellow spots, the latter with three broad yellow longitudinal bands; the median band commences generally between the eyes, but is sometimes produced forwards to the tip of the snout, and terminates on the rump; the lateral bands are broader, commence at the postero-superior angle of the orbit, and terminate abruptly at a point beyond the middle of the sides; a row of yellow spots between the bands present or absent;

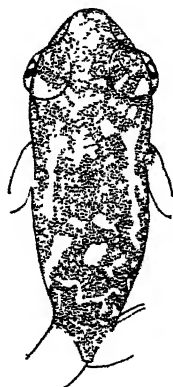


Fig. 3.—*Hyla macgregori*, Ogilby.

One of the types, a half-grown specimen. Enlarged about twice.

sometimes a well marked cross-band on the rump; sides dark brown with yellow spots; upper surface of limbs lighter brown with yellow spots, sometimes of moderate

size and scattered, but more commonly in small freckles ; lower parts creamy white. The yellow marks are frequently replaced by white ; (b) general colour much lighter brown, the yellow or white spots or bands being replaced by pale brown or dirty white ; otherwise as in var. *a*. In some young examples the upper parts are so profusely blotched with white as to almost entirely hide the dark ground colour, but, as a rule, the pattern of colouration, as given in the description of var. *a*, is not materially departed from."

"This Tree Frog appears to be common in the St. Joseph's River district, since no less than twenty-six specimens were sent down by Sir Wm. Macgregor, to whom I have much pleasure in dedicating this handsome species. The largest example measures 30mm. from snout to vent." (Ogilby.)

The affinities of this frog are with *H. thesaurensis*, Ptrs., differing in the amount of webbing, the length of the hind-limb and the position of the vomerine teeth. The colouration, too, although of the same type, differs in details.

The distribution credited to *H. thesaurensis* at present is German New Guinea and the Solomon Islands. The Papuan record is based on a specimen determined by Dr. von. Méhely as *thesaurensis*, but which I have not any hesitation in pronouncing to be a specimen of *H. macgregori*. The Austrian author's figure shows this beyond question, while the differences he notes between his specimen and Boulenger's\* Solomon Island examples are precisely the characters in which *H. macgregori* differs from *H. thesaurensis*. Therefore, the distribution of each must be amended. *H. macgregori* is confined to British and German Papua, and *H. thesaurensis* to the Solomon Islands.

The specimen figured on Plate II, fig. 3, is not quite the largest specimen, but is, perhaps, the most typical: that figured in the text is only a half-grown example. I cannot account for the discrepancies between Mr. Ogilby's description and my own.

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\* Boulenger :—Tr. Linn. Soc. Lond., xii, 1890, p. 60, pl. xi, fig. 4.

12. *HYLA EWINGII*, D. and B. *var. ALPINA*, *var. nov.*

(Plate III, fig. 2, Text fig. 4.)

*Hyla ewingii* v. *orientalis*, Fletcher, Proc. Linn. Soc., N.S.W., xxii, 1898, p. 670 (part).

Habit moderate. Head two-thirds as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rounded, a little longer than the orbital diameter; nostril elevated, slightly nearer the tip of the snout than the eye; canthus rostralis distinct; loreal region very oblique, concave. Tympanum upright-oval, perfectly distinct, separated from the eye by a distance equal to its own diameter, which is half to two-thirds that of the orbit. Interorbital space almost as broad as the upper eye-lid. Tongue broadly shield-shaped or oval, slightly nicked behind. Vomerine teeth in two fairly large, oblique, sometimes contiguous groups, between the choanæ. Limbs normal. Fingers tapering, with a very fine fringe which is very slightly enlarged at the bases between them so that it might be said that a rudiment of a web is present; if anything, this is best developed between the first and second and second and third fingers; first finger slightly shorter than the second; discs swollen, but not enlarged, a little more than half the transverse diameter of the tympanum; sub-articular pads tubercular; several rows of tubercles on the metacarpals; a large tubercle on the inner side of the base of the first finger which may bear a brown rugosity in breeding males. Toes moderate, not webbed to the discs; the third and fifth about three-quarters, the fourth about two-thirds webbed, the fringe continuing to the discs; the latter small, if anything smaller than the finger discs; a well developed inner metatarsal tubercle, in adult specimens of quite an unusual size for a *Hyla*; sub-articular tubercles distinct and a row of smaller tubercles on the under side of the phalanges and metatarsals. Tibio-tarsal articulation of the outstretched limb reaching to the eye. Skin of back and limbs warty above, the vertebral region grooved and usually devoid of warts. The warts usually commence with a distinct line of

demarcation, between the eye-lids and sometimes border the tympanum posteriorly. A distinct glandular fold above the tympanum and also on the inner side of the tarsus; sides sometimes plicate. A distinct fold across the chest. Gular region, chest, belly, underside of thighs and arms coarsely granular.

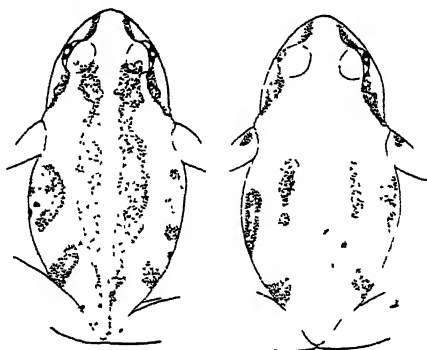


Fig. 4.—*Hyla ewingii*, var. *alpina*, Fry. Two co-type specimens showing variation in colour marking. Slightly enlarged.

*Colour (spirits)* :—Light olive green or purplish brown above, almost uniform or with dark bands which may be broken into isolated spots. Usually two broad brown bands commence between the eyes and continue to the sacral region, separated along the vertebral line. Sides with a chain of large blackish light-edged spots, the largest in the inguinal region running obliquely from the back to the groin. A narrow brown light-edged streak commences on the tip of the snout and borders the canthus to the eye; from the posterior border of the eye, whence it becomes much broader, it passes through the tympanum to the shoulder. Upper-surfaces of arms and legs variously blotched and spotted with brown. Some specimens are almost uniform greenish above, the bands being so broken as only to be represented by a few isolated spots, in which case a very large black inguinal spot is always present. Under-surfaces uniform creamy yellow.

The life colours of this frog are truly beautiful. The whole of the upper-surfaces may be either suffused with

olive green or uniformly of the purest of pea-greens. The brown bands and spots do not change to any great extent when put into alcohol, but the green almost entirely disappears. The under-surfaces are lemon yellow. The resemblance of this frog to *Hyla regilla*, Bd. and Gir., of North America, as regards its life colours, is worthy of note. *H. regilla* has been beautifully figured by Miss Mary C. Dickerson,\* two plates showing clearly the enormous range of colour and marking displayed by different individuals, many phases of which forcibly suggest those of *H. ewingii* v. *alpina*.

|   |        |
|---|--------|
| Length of head, to hinder edge of tympana | 12 mm. |
| Width of head at tympana .. ..            | 17 mm. |
| Total length, snout to anus .. ..         | 48 mm. |
| Length of hind-limb to tib.-tars. art. .. | 41 mm. |

*Locs.* :—Twenty-two specimens from Mount Kosciusko, Monaro District, Southern tableland, New South Wales. Three specimens collected by Mr. A. R. McCulloch were taken at an altitude of 5,200 feet. Mr. Charles Hedley and Mr. Robert Helms have taken them at 5,500 feet, while four collected by Dr. T. H. Johnston are said to be from 7,000 feet altitude. I have to thank Messrs. Hedley, Johnston, and McCulloch for their kindness in bringing me specimens alive.

This new variety can be distinguished from the other varieties of *Hyla ewingii*, D. and B., by its warty back, scarcity of webbing, small discs and tapering fingers, and by the predominance of green in its life colouration. As regards the amount of webbing and size of the finger discs, however, var. *alpina* overlaps some examples which are true specimens of var. *orientalis*.

*Type* :—In the Australian Museum, Reg. No. R. 4644.

Mr. J. J. Fletcher† has gone very fully into the relative values and distribution of the proposed varieties of *H. ewingii*. As the result of a careful examination of over one hundred specimens, he arranges the varieties as follows :

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\* Dickerson :—The Frog Book, New York, 1907, col. pls., viii—ix.

† Fletcher :—Proc. Linn. Soc., N.S.W., xxii, 1898, pp. 665-73.

*H. ewingii* v. *typica* (Tasmania and Victoria).

*H. ewingii* v. *calliscelis*, Ptrs. (Tas., Vict., South and West Australia).

*H. ewingii* v. *krefftii*, Gthr. (New South Wales).

*H. ewingii* v. *orientalis* Flet. (Coast of N.S.W.).

The records of "South" and "West Australia" are based on Peters'\* original type locality, and Boulenger's† record respectively, no specimens from these States being available to him.

*H. ewingii* v. *orientalis*‡ was described as a new variety, to receive the New South Wales specimens which would not fit in with v. *krefftii*, Gthr., and overlap the latter in range. Boulenger|| records v. *krefftii* from Port Denison, Queensland, but I am inclined to mistrust that locality, even with a specimen in the Australian Museum with a label, of doubtful validity, showing the locality "Queensland."

In the Australian Museum collection *H. ewingii* is richly represented by over one hundred specimens from many localities. After examining these I find my conclusions are slightly at variance with those of Mr. Fletcher. My understanding of the varieties is as follows:—

*Hyla ewingii* v. *typica* (Tas., Vic., Iss. Bass Str.)

*H. ewingii* v. *calliscelis*, Ptrs. (S. and W. Austr.)

*H. ewingii* v. *krefftii*, Gthr. (N.S.W.)

*H. ewingii* v. *alpina*. Fry (Tablelands, Southern N.S.W.)

*H. ewingii* v. *orientalis*, Flet. (Tas.?, Vic., N.S.W.)

Two specimens of *H. ewingii* v. *calliscelis*, Ptrs., from South Australia\*\* show conclusively that it was a mistake to consider specimens with a spotted groin from Eastern Australia as belonging to that variety. Thus I regard v. *calliscelis* as confined to South and Western Australia.

\* Peters:—Mon. Berl. Ac., 1874, p. 620.

† Boulenger:—Brit. Mus. Cat. Batr. Sal., 1882, p. 407.

‡ Fletcher:—Proc. Linn. Soc., N.S.W., xxii, 1898, p. 670.

|| Boulenger:—Brit. Mus. Cat. Batr., Sal., 1882, p. 407.

\*\* These two specimens are from Adelaide, Peters' type locality.

Mr. Fletcher's Tasmanian and Victorian specimens of *v. calliscelis* I have placed in his *v. orientalis*, which he had considered as confined to eastern New South Wales. Whether this latter course is correct or not I cannot be quite certain, for *v. orientalis* has not been definitely characterised by its author. At the same time I am unable to find sufficient differences between these Tasmanian and Victorian and the New South Wales examples with spotted groins, to warrant their being regarded as a distinct variety, with a new name. As the inguinal marks in Eastern specimens, unlike the South and West Australian examples, are not associated with any structural characteristics, this seems the most advisable course.

*H. ewingii v. calliscelis* may be distinguished from all other varieties, save *v. krefftii*, by the large finger discs, which are as large as or larger than the tympanum, by the more extensive webbing of fingers and toes, and by the large very accentuated purple blotches always present on the groin and hinder side of the thighs. From *v. krefftii* it is at once distinguished by the latter character alone. It reaches a larger size than all but *v. alpina*, and is slender in habit like *v. krefftii*. The inguinal and thigh marks of *v. calliscelis* are very different in nature to those which occur in occasional instances in Eastern Australian specimens of *v. orientalis*, and do not vary among themselves to such an extent. They stand out in bold relief on a pale ground and resemble deep, even-edged, purple ink-blotches. It is a most natural thing that, following Dr. Boulenger's meagre description of *v. calliscelis*, the Eastern Australian specimens with spotted groins should have been referred to that variety, but with two well-preserved specimens from Peters' type locality, Adelaide, I do not hesitate to put forward the correction as set out above.

No key to the varieties of *H. ewingii* could be quite satisfactory, for the various forms, though their extremes are very different, nevertheless overlap to a certain extent. The following will serve in the majority of cases :—

Key to varieties of *Hyla ewingii*, D. and B.

- A. Discs of fingers as large as, or a little larger than, the tympanum.  
Fingers not merely fringed at the base but distinctly webbed.

b. Groin and hinder thigh with accentuated purple blotches. S. and W. Austr. .. .. *H. ewingii* v. *calhsclis*, Ptrs.

c. Groin and thighs yellowish with faint brown speckles. (N.S.W.)  
*H. ewingii* v. *krefftii*, Gthr.

A.A. Disc of fingers smaller than tympanum. Fingers with a web which is merely a continuation of a more or less obvious fringe.

d. Back warty. Gular region and undersurfaces of arms coarsely granular. Green or olive above. Kosciusko Plateau.  
*H. ewingii* v. *alpina*, Fry.

dd. Back smooth or minutely granular.

e. Back usually greyish. A distinct *silvery* streak from the corner of the mouth. Sides of body and thighs yellow or with delicate speckles. (Tas. and Vic.)  
*H. ewingii* v. *typica* (Blgr. and Flet.)

f. Back usually brownish. Streak at corner of mouth usually yellowish and not very distinct. Sides of body and thighs with brownish spots. (Tas.?, Vic., N.S.W.) .. *H. ewingii* v. *orientalis*, Flet.

### 13. *Hyla lesueurii*, D. and B., var. *vinosa*, Lamb.

(Plate II, Fig. 2, Text fig. 5.)

*Hyla vinosa*, Lamb, Ann. Q'land Mus., No. 10, 1911, p. 27.

*Hyla lesueurii*, D. and B., var., Fry, Rec. Austr. Mus., ix, 1912, p. 106.

Head slightly broader than long, the measurement taken at a line drawn between the hinder margins of the tympana. Snout prominent, longer than the diameter of the eye. Canthus rostralis angular, loreal region oblique, not concave. Nostril nearer the tip of the snout than the eye. Interorbital space as broad as the upper eye-lid. Tympanum very distinct, slightly more than half the diameter of the eye. Tongue sub-circular, slightly nicked and free on the sides and behind. Vomerine teeth in two slightly oblique contiguous groups between the middle of the choanæ. Fingers free, first and second equal; discs enlarged, that of the third finger slightly more than half the tympanum. A large tubercle on the base of the first finger; no external rudiment of pollex; two small approximated metacarpal tubercles, and several small indistinct palmar tubercles. Toes webbed to the discs except on the fourth; discs about as large as those of

the fingers ; a small inner and a larger outer metatarsal tubercle. Skin smooth above, granulate on the belly and symphysis. A fold of skin runs from the eye to the shoulder,

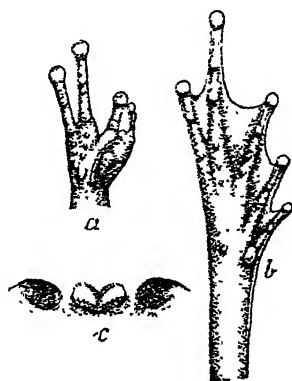


Fig. 5.—*Hyla lesueurii*, D. and B., var. *vinosa*, Lamb.  
a hand, b foot. c vomerine teeth (enlarged).

above the tympanum ; another along the inner edge of the tarsus. Tibio-tarsal articulation reaches far beyond the tip of the snout.

*Colour (formalin)* :—Vinous brown above, with faint irregular smudge. Sides lighter. Under-surfaces creamish. An indistinct dark band between the eye-lids. A brownish band commences behind the eye, and passes through the tympanum to the shoulder, where it breaks up. Groin with about half-a-dozen large dark brown spots, the largest, light-edged. Front side of thighs with an irregular brownish band of markings ; hinder-side black with white marblings. Shank with a few brown spots on the inner side.

The above description and the figure on Plate II. were drawn up from the type specimen of *Hyla vinosa*, Lamb., kindly lent to me by Dr. R. Hamlyn-Harris, Director of the Queensland Museum. In the original description this frog was compared to *Hyla nigrofrenata*, Gthr., but its affinities are more with *H. lesueurii* than that species. I am inclined to regard the differences as too slight to allow it specific distinction from the latter. Nevertheless, it is a good geographical race, although it does not wholly replace *H. lesueurii* in the northern State. I have recently

received from Dr. T. L. Bancroft several specimens of *H. lesueurii* which resemble the typical form, *i.e.*, that found round Sydney, New South Wales. These were collected at Eidsvold, Burnett River, Queensland. Northern Queensland examples of var. *vinosa* are larger than any specimens of the typical form that I have seen, and they also possess relatively much larger discs. If with additional material these characters are proved quite stable, it may then be necessary to raise this form to specific rank. At present such a course could not be substantiated.

Mr. Lamb does not appear to have realised in his original description, the full significance of certain features of taxonomic value, and, as a consequence, my description will be found to differ considerably from that given by him, and at the same time, to be directly opposed in a number of salient points.

*Type* :—In the Queensland Museum, Brisbane.

## ii. DESCRIPTION AND NOTES ON THREE LIZARDS.

### 1. *ÆDURA MONILIS*, de Vis.

(Pl. III, fig. 2.)

*Ædura monilis*, de Vis., Proc. Linn. Soc., N.S.W. (2), ii, 1888, p. 812.

Head oviform, depressed (in the figured specimen the occipital region is convex and rather swollen). Snout as long as the distance between the eye and the ear opening, once-and-two-thirds to almost twice as long as the orbital diameter. Ear opening very small, one-third to almost half the diameter of the eye, sub-oval, very oblique. Rostral rectangular, the outer angles rounded by the nasal opening, half or a little less as high as broad, with a distinct median cleft above dividing it for barely half its height. Supranasals in contact; nostrils bordered by the rostral, first upper labial, a supranasal, and three post-nasal granules; behind these the granular scales of the snout are not visibly enlarged. Labials  $\frac{9-10}{10-11}$ . Head covered with hexagonal, sub-equal granules, smallest on the nape.

Mental shield slightly broader than the adjoining sublabials, truncate, and tapering posteriorly. Scales of body flattened and mostly hexagonal, those of the middle of the back larger than those of the sides, but if anything, slightly smaller than those of the ventral surface. Limbs moderate. Tail rounded, tapering, covered by rings of quadrangular, brick-like scales. (The tail of the figured specimen is reproduced.) An enlarged, flattened granule laterally on the base of the tail. Seven to nine preanal and femoral pores in a series scarcely interrupted medially.

*Colour (spirits):*—Light yellowish (faded) or greyish-brown above, with seven or eight pairs of ocelli (the fellows of each pair sometimes contiguous) of dark purplish-brown. The most anterior of these in the form of a half-moon-shaped nuchal mark. A dark line from the nostril to the occiput; another short one medially on the snout. Upper-labials yellowish. Upper surfaces of head and body covered (except for the ocelli) by delicate purplish reticulations or spots. Tail when intact, with three or four ocelli, but when reproduced it is irregularly streaked and spotted with purplish. Under-surfaces uniform yellowish.

Measurements of figured example:—

|                                     |        |
|-------------------------------------|--------|
| Length of body, snout to anus .. .. | 78 mm. |
| Length of tail .. ..                | 42 mm. |
| Length of head .. ..                | 22 mm. |
| Width of head .. ..                 | 14 mm. |
| Length of fore-limb .. ..           | 22 mm. |
| Length of hind-limb .. ..           | 28 mm. |

*Localities:*—There are four specimens of this gecko in the Museum collection. One was collected by Mr. D. A. Porter at Tamworth, Northern Tableland, New South Wales; another was presented to the Trustees by Dr. S. J. Johnston, B.A., and was taken at Trangie, Western New South Wales. Two other very old, poorly conditioned examples are without data.

It is best not to regard this species as a local variety of its better known ally, *Edura tryoni*. The colouration is characteristic and constant, while several other minor characters distinguish the two. Also, Mr. Porter has forwarded a specimen of a typical *Edura tryoni* from Tamworth, a locality from which *Æ. monilis* is known.

2. *CALOTES CRISTATELLUS*, Kuhl.

*Calotes cristatellus* (Kuhl.), Barbour, Mem. Mus. Comp. Zool. Harvard., 1912, xlv.

To the long list of localities in the East Indies from which this species is recorded by Barbour (see above) must be added Dutch New Guinea. In the Museum Collection are ten specimens from "North West New Guinea, presented to the Trustees in 1889 by Captain Strachan."

3. *GONYOCEPHALUS SPINIPES*, A. Dum.

A young specimen which is referred to this species with some doubt comes from Ourimbah, near Gosford, about 40 miles north of Sydney, New South Wales. This extends the range of the widely dispersed genus *Gonyocephalus* about two hundred miles southwards. The extension of the East Indian genus *Gonyocephalus* into New South Wales contrasts markedly with the distribution of other Papuan migrants such as *Rana papua*, *Austrochaperina*, and *Tropidophorus*, which remain confined to the north-east coast of Queensland.

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iii. ON A NEW CHELODINA FROM AUSTRALIA,  
WITH A KEY TO THE GENUS.

(Plate IV.)

*CHELODINA INTERGULARIS*, sp. nov.

Carapace not depressed, evenly arched, oval, broadest at a line drawn through the middle of the fourth vertebral shield. No vertebral groove in the adult. Shields and bones with a network of anastomosing grooves. Third to seventh marginal shields of each side with weakly deflexed margins. Nuchal shield large, a little broader than long. First vertebral shield only as large as the second; it is 1mm. broader and 1mm. shorter than the second. Plastron a little more than twice as long as broad, broadly rounded anteriorly and feebly bayed between the gulars, considerably narrower than the carapace in that region; posterior lobe deeply bayed behind, and constricted in the region of the femoro-anal suture; about as wide as the anterior lobe, and a little more than half the greatest width

of the carapace; the longest plastral shield is the intergular which is once-and-three-quarters as long as broad, longer than the pectorals, once-and-three-quarters as long as the suture of the pectorals, almost as long as its distance from the femorals; it separates the gulars anteriorly, forming the median portion of the periphery of the anterior lobe. Humerals considerably larger than the gulars. The pectoral shields and their suture are slightly longer than the femorals and their suture. Suture between the abdominal shorter than that of any other pair of shields, twice-and-one quarter in the length of the intergular. Suture between the anals as long as that between the femorals. Depth of body twice-and-two-thirds in the total length. Soft parts, limbs and head absent.

Measurements in millimetres. Taken with callipers:—

|   |    |    |         |
|---|----|----|---------|
| Total length of carapace                | .. | .. | 192 mm. |
| Greatest width of same                  | .. | .. | 132 mm. |
| Length of plastron, along median line.. |    |    | 142 mm. |
| Width of plastron, medially             | .. | .. | 72 mm.  |

Described from a single specimen consisting of a carapace and plastron, mostly devoid of shields. On the label is the somewhat vague locality "Australia?"

*Type*:—In the Australian Museum, Sydney. Reg. No. R. 6255.

This new form combines the characters of several species. The outline is nearest to that of *C. expansa*\*, but in the condition of the first vertebral and the anal shields it approaches *C. novæ-guineæ*.† The nuchal shield and contour are much the same as in *C. siebenrocki*‡. From all the species of the genus, however, it is at once distinguished by the remarkable intergular shield, which completely separates the gulars anteriorly. In this character and in the condition of the first vertebral shield it approaches *Pseudemydura umbrina*,|| Siebenrock. In the genus *Chelodina* the condition exhibited by the intergular in this species is approached only by *C. oblonga*,§ in which species it

\* Boulenger:—Brit. Mus. Cat. Chel., 1889, p. 216.

† Boulenger:—*l.c.* p. 215, pls. v.-vi.

‡ Werner:—Verh. Zool.-bot. Ges. Wien., Vol. 51, 1901, p. 602, tab. 5.

|| Siebenrock:—Anz. Akad. Wiss. Wien., No. 22, 1901, pl. 1., and S.B. Akad. Wiss. Wien., Vol. cxvi, 1907, p. 1207, Tab.

§ Boulenger:—*l.c.* p. 216.

sometimes almost separates the narrow gulars, but the elongate form and the size of the first vertebral shield of the latter enable us to easily distinguish the two forms. In the genus *Emydura* the intergular always separates the gulars, but in that genus the humerals meet behind it and form an extensive suture. The first vertebral too, is not broader than the second. I have no hesitation, however, in placing such a globose form in the genus *Chelodina*. The key here given serves to show the relationships of the seven species.

Key to the species of the genus *Chelodina*:—

A. Intergular more than twice as long as the suture between the pectorals.

B. Front lobe of plastron much narrower than the carapace.

Suture between the anals twice as long as that between the pectorals and humerals, which are equal. *C. novæ-guinææ*, Blgr.

Suture between anals a little longer than that between the femorals, but much longer than that of the pectorals.

*C. steindachneri*, Shnrk.\*

B.B. Front lobe of plastron nearly as wide as the front lobe of carapace. *C. longicollis*, Shaw.

A.A. Intergular not twice as long as the suture between pectorals.

C. First vertebral shield markedly broader than second. Gulars in contact.

d. Plastron (without bridge) twice as long or less than twice as long as broad.

Second and third vertebrals longer than broad. *C. expansa*, Gray.

Second and third vertebrals broader than long. *C. siebenrocki*, Werner.

dd. Plastron more than twice as long as broad.

Second and third vertebrals considerably longer than broad. *C. oblonga*, Gray.

C.C. First vertebral shield as long as and as broad as second. Gulars separated by the intergular.

*C. interguaris*, Fry.

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\* Siebenrock:—K. Ak. Wiss. Wien (Math-naturw.) Anz. No. xviii. 1914, p. 1.

iv. DESCRIPTIONS OF TWO NEW SPECIES OF  
PSEUDELAPS, AND A KEY TO THE GENUS.

1. PSEUDELAPS CHRISTIEANUS, *sp. nov.*

(Text fig. 6.)

Size moderate, habit moderate, tail rather stout. Head slightly distinct from neck; eye much larger than its distance from the mouth; rostral twice as broad as deep, plainly visible from above; internasals two-thirds the length of the præfrontals; præfrontals contained once-and-two-thirds in the length of the frontal, the lower posterior corner just in contact with the third labial; frontal much broader in front than behind, once-and-one-fifth as long as broad, three-quarters the length of the parietal, nearly as long as its distance from the tip of the snout, more than twice as broad as the small supraocular; nasal entire,

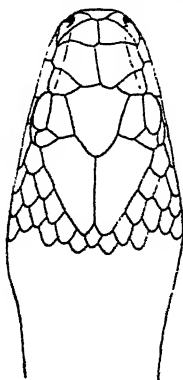


Fig. 6.—*Pseudelaps christieanus*. Drawn from type. Enlarged.

widely separated from the præocular, and separated from each other anteriorly by a backward projection of the rostral; præocular single, in contact with the front edge of the frontal; two postoculars; temporals 2+2, lower anterior wedged in between 5th and 6th upper labials; six upper labial, third and fourth entering the eye; seven or eight lower labials, the first four in contact with the anterior chin shields which are longer than the posterior. Scales smooth, highly polished, in 17 rows. Ventrals, 165; anal divided. Sub-caudals in 38 pairs.\*

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\* The very tip of this tail appears as though it might be injured, in which case the above count will be slightly below what it should be.

*Colour (spirits):*—Scales of upper-surface fawn-brown, each with a yellow centre; on the sides of the body the scales are only brown edged, the row next to the ventrals not coloured. Upper-surface of head rich chocolate brown. A broad nuchal band of yellowish in which area the scales are spotted with brown; behind this, dark brown fading to the colour of the back. Upper-lips and under-surfaces creamy white.

Total length of type .. .. 255 mm.

Length of tail .. .. 45 mm.

*Localities:*—A single adult specimen from Port Darwin, Northern Territory, North Australia. This specimen formed part of a number of collections forwarded by Mr. Hugh W. Christie, Lighthouse-keeper, at Point Charles, and which I hope to deal with subsequently.

*P. christieanus*, Mihi, is easily distinguished from *P. diadema*, Schlegel, by having 17 rows of body scales, a larger eye, a narrower snout and frontal shield, and by having the præocular shield forming an extensive suture with the anterior edge of the frontal; this suture is of about the same extent as that between the præfrontal and frontal, an unique condition. In *P. diadema* the præocular in one or two cases just touches the antero-lateral angle of the frontal, the suture being immeasurably small, but quite the typical form is that in which it is separated from the frontal, the supraocular forming a suture with the præfrontal. When compared side by side, the narrower snout of my new species is a noticeable feature. Instead of the head being glossy black and the nuchal spot sharply defined as in *P. diadema*, it is brownish, the nuchal collar being spotted with the same colour.

In the British Museum Catalogue of Snakes, Dr. Boulenger records *P. diadema* from "North Australia"; perhaps this specimen belongs to *P. christieanus*, which at a cursory glance might be mistaken for that species. Messrs. Lönnberg and Andersson\* however, mention a specimen which they refer to *P. diadema* from Western Australia, which undoubtedly belongs to this species. I think it quite possible that the true *P. diadema* does not occur in Western Australia.

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\* Lönnb. and Anderss. :—Kongl. Sv. Vet. Handl. Bd. 52, No. 3, 1913, p. 14.

2. *PSEUDELAGS MINUTUS*, sp. nov.

(Text fig. 7.)

Size very small; habit moderate, tail short, tapering. Head slightly distinct from neck; eye much larger than its distance from the mouth; rostral a little broader than deep, visible from above; internasals shorter than the præfrontals, the latter contained twice or a little more in the length of the frontal; frontal once-and-three-quarters to twice as long as broad, broadest behind, shorter than the parietals, longer than its distance from the tip of the snout, about as broad as or a little broader than the supra-ocular; nasal entire, in contact with the præocular; nostril small; præocular single; two postoculars; tem-

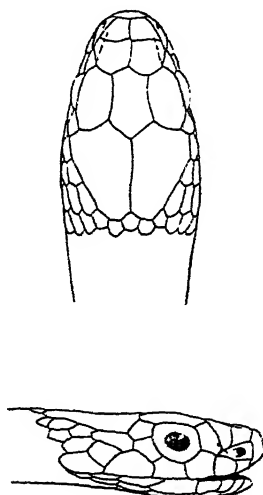


Fig. 7.—*Pseudelaps minutus*, Fry. Drawn from type. Enlarged.

porals 2 + 2, lower anterior wedged in between 5th and 6th upper labials, in one specimen united with the sixth on both sides of the head; six upper labials, third and fourth entering the eye; six lower labials, anterior four in contact with anterior chin shields, which are longer than the posterior. Scales in 15 rows, quite smooth, with a dull sheen. Ventrals 148-153; sub-caudals single, 51-59, tail terminating in a long cylindrical pointed scale. Anal entire.

*Colour (spirits)*:—Dark olive or black above, all the scales with minute punctations of olive grey. Head black, uniform or covered with grey speckles most profuse on the sides and lips where the black ground colour is proportionately at a minimum; sometimes a dark streak on the canthus. A curved yellowish nuchal collar. Chin and throat blackish, speckled with grey. Ventrals yellowish, not black bordered, but dark and light spotted on the outer ends. Under-surface of tail darker than body.

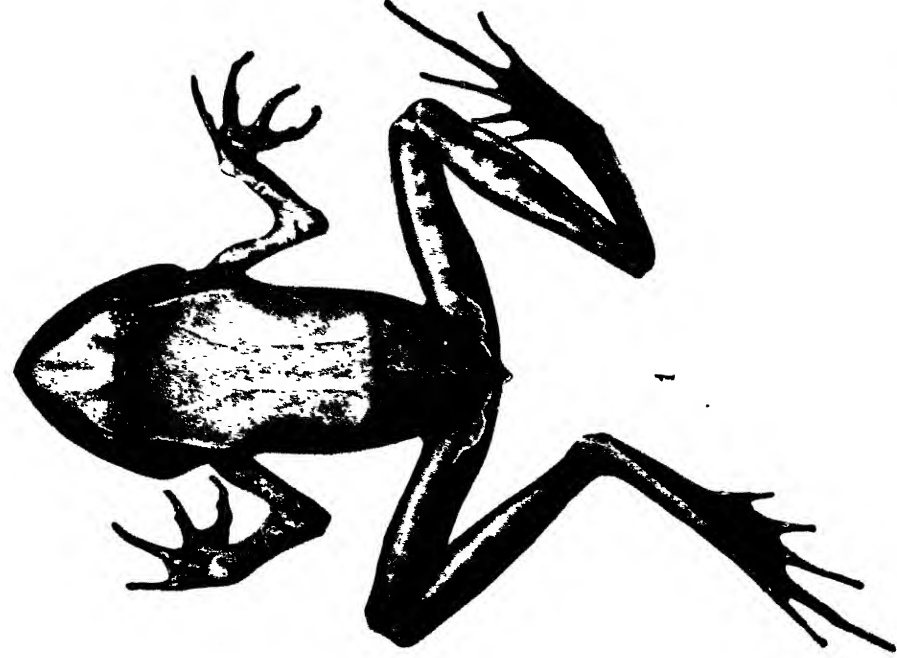
|                      |    |    |    |         |
|----------------------|----|----|----|---------|
| Total length of type | .. | .. | .. | 155 mm. |
| Length of tail       | .. | .. | .. | 30 mm.  |

*Localities*:—Three specimens which, although very small, do not appear to be young snakes. One was collected and presented to the Trustees by Mr. Thos. Steel, F.L.S., and comes from Wilde's Meadow, near Moss Vale, eighty miles south of Sydney, New South Wales; another was presented by Mr. A. H. S. Lucas, M.A., and is from one of two localities, Tamworth or Guntawang, but the donor is not certain which; the third is from Colo Vale, south of Sydney, New South Wales, presented by Mr. J. Summers.

*Type*:—In the Australian Museum, Sydney, Reg. No. R.3971.

This species is probably one of the smallest snakes known. It appears to be adult or very nearly so when six inches long. It is allied to *P. krefftii*, Gthr., from which it differs in the temporals being 2+2, the narrower frontal, greater number of sub-caudals, entire anal shield, and colouration. The following is a key to the species of the genus *Pseudelaps*:—

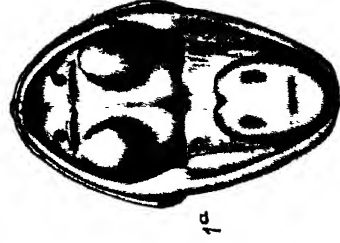
- A. Nasal in contact with or narrowly separated from the præocular.
  - B. Nasal Shield divided.
    - Temporals 2+2. *P. mulleri*, Scheg.
    - Temporals 1+2. *P. squamulosus*, D. & B.
  - B.B. Nasal shield entire.
    - C. Temporals 2+2. Sub-caudals 51-59. Anal entire.
      - A yellow occipital mark. *P. minutus*, Fry.
    - C.C. Temporals 1+2. Sub-caudals, 26-38. Anal divided.
      - Ventrals 146-156. *P. krefftii*, Gthr.
      - Ventrals 167-172. *P. fordii*, Krefft.
      - Ventrals 176-193. *P. harriettæ*, Krefft.
- A.A. Nasal widely separated from the præocular.
  - Temporals 2+2.
    - Scales in 15 rows. *P. diadema*, Schleg.
    - Scales in 17 rows. *P. christieanus*, Fry.



*Lechrodus melanopyga*, Doria.



*Phauerois fletcheri*, Blgr.







*Hyla macgregori*, Ogilby.



*Hyla lesueuri*, v. *rinosi*, Lamb.



Fig. 1—*Hyla ewingii*, v *alpina*, Fry.

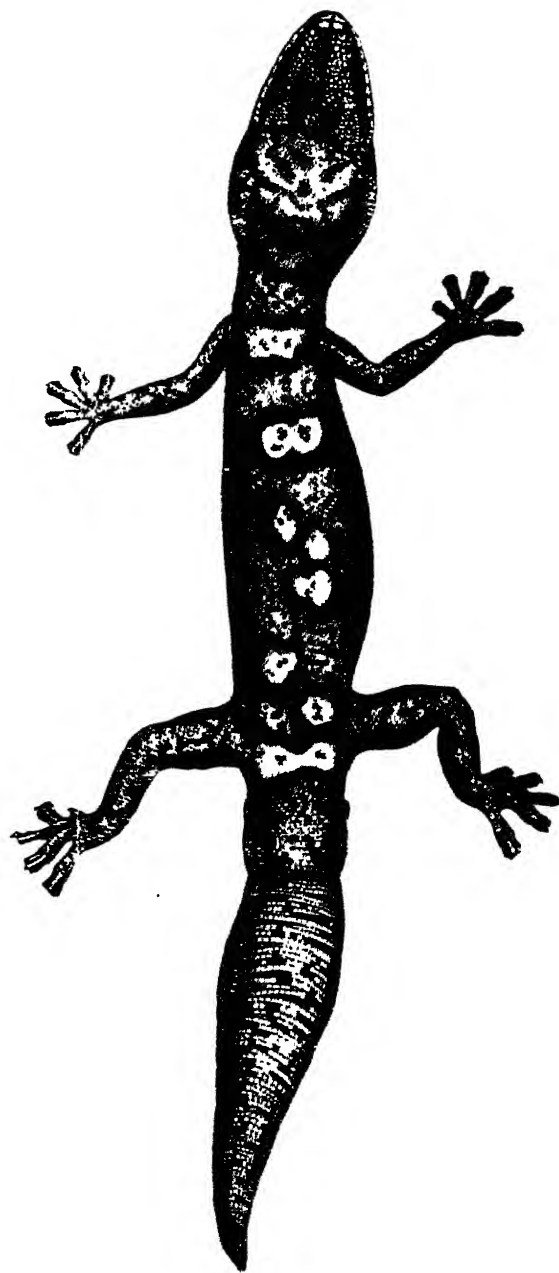
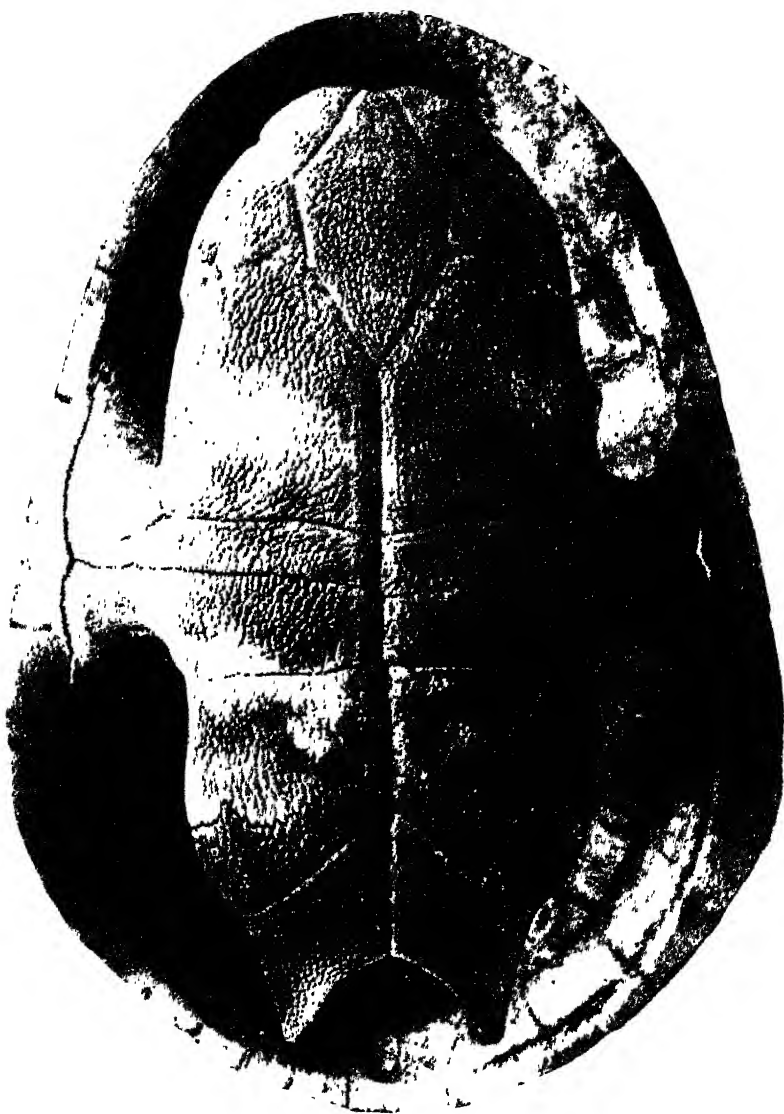


Fig. 2.—*Oedura monilis*, de Vis.







*Chelodina interguularis*, Fry.



I have little doubt that *P. sutherlandi*, de Vis, is only a young *Demansia*. Mr. H. A. Longman, of the Queensland Museum, tells me that, should we admit this, an examination of de Vis' types of *P. warro*, and *P. bancroftii* shows that they also must be transferred. Therefore, I have not included those species in my key.

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EXPLANATION OF PLATES I-IV.

- Plate I. Fig. 1. *Lechriodus melanopyga*, Doria. British New Guinea. Enlarged.
- Fig. 1a. *Lechriodus melanopyga*, Doria. Mouth of same specimen. Enlarged.
- Fig. 2. *Phanerotis fletcheri*, Blgr. Ourimbah, New South Wales. Palate enlarged.
- 
- Plate II. Fig. 1. *Hyla macgregori*, Ogilby. British New Guinea. Enlarged. (From one of the types).
- Fig. 2. *Hyla lesueurii*, D. and B. var. *vinosa*, Lamb. Brisbane, Queensland. Nat. size. From type.
- Fig. 2a. *Hyla lesueurii*, D. and B., var. *vinosa*, Lamb., Brisbane, Queensland. Nat. size. Palate of same specimen.
- 
- Plate III. Fig. 1. *Hyla ewingii*, D. and B. var. *alpina*, Fry. Mt. Kosciusko, New South Wales. Slightly enlarged. From type.
- Fig. 2. *Edura monilis*, de Vis. Trangie, New South Wales. Enlarged.
- 
- Plate IV. *Chelodina intergularis*, Fry. Australia. Plastron slightly reduced. From type.
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EXPLANATION OF TEXT FIGURES 1-7.

- Fig. 1. *Phanerotis fletcheri*, Blgr. Dorsal and lateral view of head.
- Fig. 2a. *Limnodynastes dorsalis*, Gray. Sacral vertebra.
- 2b. *Heleioporus albopunctatus*, Gray. Sacral vertebra.
- 2c. *Lechriodus melanopyga*, Doria. Sacral vertebra.
- Fig. 3. *Hyla macgregori*, Ogilby. One of the types.
- Fig. 4. „ *ewingii* var. *alpina*, Fry. Two co-types. Colour variation.
- Fig. 5. „ *lesueurii* var. *vinosa*, Lamb. Hand, foot and vomerine teeth of type specimen.
- Fig. 6. *Pseudelaps christieanus*, Fry. Upper head shields. From type.
- Fig. 7. „ *minutus*, Fry. Dorsal and lateral view of head of type.

# NOTES ON A FEW INTERESTING PLANTS FROM MORETON BAY.

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By C. T. WHITE.  
(Botanic Gardens, Brisbane.)

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(Read before the Royal Society of Queensland, July 26th,  
1915.)

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THE following notes relate to a few plants collected during the past couple of years around Moreton Bay, and which seem to be worthy of note. Except where otherwise stated, the specimens have been gathered personally by myself and several of them on excursions of the local Field Naturalists' Club.

## MALVACEÆ.

*HIBISCUS DIVERSIFOLIUS*, Jacq. (var. *genuinus*, Hochr. Ann. du. Conserv. et du Jardin Bot. Geneva, (1900) 119).

Quite recently I have collected this species in swamps at Sandgate and Bribie Island (Moreton Bay) and Mudgeeraba (South Coast Railway). Flowers, yellow or greenish-yellow, with a dark centre. Previously the inclusion of this plant in the Queensland flora rested on doubtful specimens collected at Rockhampton by M. Thozet.

## RUTACEÆ.

*ASTEROLASIA WOOMBYE*, Bail. Bribie Island; a very common shrub.

## LEGUMINOSEÆ.

DESMODIUM POLYCARPUM, *D.C.* Bribie Island.

VIGNA LUTEOLA, *Benth.* Sandgate and Bribie Island.

ACACIA CINCINNATA, *F. v. M.* Bribie Island.

The finding of this *Acacia* so far from the previously recorded habitats is of especial interest. It is a large tree with a dark rough bark, and is generally found on the edge of swamps. The trunk rises for a considerable height without any signs of branching.

## RHIZOPHOREÆ.

CERIOPS CANDOLLEANA, *Arn.* Mangrove swamps between Sandgate and Humpybong.

## MYRTACEÆ.

LEPTOSPERMUM FLAVESCENS, *Sm.* var. *citriodorum*, *Bail* Q'land Ag. Jl., XV (1905), 781.

This variety is very common in the swamps in some places on Moreton and Stradbroke Islands. Burleigh Heads (*J. E. Young*) is another additional habitat. It evidently has a wide range in Southern Queensland, but apparently is restricted to coastal swamps. This and *L. liversidgei*, *Baker and Smith*,\* recorded from several coastal localities in N.S.W. are evidently identical.

EUCALYPTUS PLANCHONIANA, *F. v. M.* Stradbroke Island.

These specimens show great variability in the length of the fruit-stalk, in one specimen it being  $\frac{1}{2}$  inch (12.5mm) long.

## PROTEACEÆ.

BANKSIA SERRATA, *Linn. f.*

I have recently collected specimens of this from Stradbroke Island and Bribie Island; in the latter locality

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\*Journ. and Proc. Roy. Soc. N.S.W., XXXIV (1905), 124,

it is very common on the ocean side of the island. The trees, so far as I have observed, are always of a narrow pyramidal shape.

*BANKSIA ÆMULA*, *R. Br.*

This is very common in coastal localities in Southern Queensland; the trees are generally of a very irregular spreading growth and reach large dimensions. Although very common, I have never seen it of shrubby growth as it is said to occur most commonly in New South Wales

### RESTIACEÆ.

*LEPTOCARPUS TENAX*, *R. Br.*

This species, but recently recorded for Queensland. I have collected at the following localities: Russell Island, and Bribie Island (Moreton Bay), and Lake Wybah (North Coast Line).

### CYPERACEÆ.

*CYPERUS CONICUS*, *Boeckl.* Bribie Island.

The leaves and stems have a glaucous tint.

### GRAMINEÆ.

*POLLINIA ARGENTEA*, *Trin.* Bribie Island.

I have seen this grass growing in several localities in Southern Queensland, always in swampy land.

*ARTHRAOXON CILIARIS*, *Beauv.* var. *AUSTRALIS*, *Benth.* Myora (Stradbroke Island).

The only other specimen of this grass in the Queensland Herbarium is a very poor one from Toowoomba, the var. *tenellus*, *Benth.*

*ERAGROSTIS BROWNII*, *Nees*, var. *PUBESCENS*, *Bail.*

This grass, previously only recorded from tropical Queensland, I have found in great abundance in the sandy

shore lands of Bribie Island, and have also gathered specimens at Fig Tree Pocket (Brisbane River) and Stradbroke Island.

Specimens have also been gathered at Noosa, by Miss E. N. Parker, and at Yeppoon, by Mr. E. W. Bick, so the grass would appear to extend nearly along the whole range of the Queensland coast.

LEPTURUS REPENS, *R. Br.* Sand-hills, Bribie Island :  
not previously recorded from extra-tropical Queens-  
land.

#### FILICES.

LINDSÆA DIMORPHA, *Bail.* Bribie Island.

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# A LIST OF THE RECORDED FRESHWATER PROTOZOA OF QUEENSLAND

WITH A NUMBER OF NEW RECORDS.

By C. D. GILLIES, B.Sc.

Biology Laboratory, University of Queensland.

(Read before the Royal Society of Queensland, 30th August, 1915.)

THE following is a list of the recorded Freshwater Protozoa of Queensland, together with a number of new records for this State, the latter being indicated by an asterisk (\*).

| SPECIES.  | RECORDER.       | LOCALITY.   |
|---|-----------------|---|
| CLASS SARCODINA.<br>SUB-CLASS RHIZOPODA<br>Order Amoebina |                 |   |
| <i>Amoeba limax</i> , Duj. .                              | Schewiakoff (1) | Brisbane, Dec., 1889.   |
| * <i>Amoeba proteus</i> , Leidy.                          | .. ..           | Sandgate, June, 1915.   |
| Order Conchulina.   |                 |   |
| * <i>Arcella angulosa</i> , Perty.                        | .. ..           | Bribie Is., April, 1915.  |
| * <i>Arcella discoides</i> , Ehrb.                        | .. ..           | Bajool, April, 1915.  |
| * <i>Arcella vulgaris</i> , Ehrb.                         | .. ..           | Bribie Is., April, 1915.<br>Bajool, April, 1915.                        |
| * <i>Centropyxis aculeata</i> ,<br>Stein.                 | .. ..           | Chelmer, July, 1914;<br>Bribie Is., April, 1915.                        |
| * <i>Centropyxis eornis</i> ,<br>Leidy. . . .             | .. ..           | Bajool, April, 1915.  |
| * <i>Diffflugia acuminata</i> , Ehrb.                     | .. ..           | Darra, July, 1914.  |
| * <i>Diffflugia globulosa</i> , Leidy.                    | .. ..           | Bribie Is., April, 1915.;<br>Darra, July, 1914;<br>Bajool, April, 1915. |
| * <i>Diffflugia lobostoma</i> , Leidy.                    | .. ..           | Darra, July, 1914.  |
| * <i>Diffflugia oblonga</i> , Ehrb.                       | .. ..           | Darra, July, 1914;<br>Chelmer, July, 1914;<br>Bajool, April, 1915.      |
| * <i>Euglypha alveolata</i> , Duj.                        | .. ..           | Darra, July, 1914.  |
| * <i>Euglypha cristata</i> , Leidy.                       | .. ..           | Bribie Is., April, 1915.  |
| * <i>Trinema enchelys</i> , Leidy.                        | .. ..           | Sandgate, June, 1915;<br>Bribie Is., April, 1915;<br>Darra, July, 1914. |

| SPECIES  | RECORDER        | LOCALITY  |
|--|-----------------|---|
| SUB-CLASS HELIOZOA   |                 |   |
| Order Aphrothoraca.  |                 |   |
| <i>Actinophrys eichornii</i> ..                                | Colledge (2)    | Sandgate, June, 1915.<br>Caloundra, 1914.         |
| * <i>Actinophrys sol.</i> Ehrb. ..                             | .. ..           |   |
| <i>Actinosphaerium</i> , sp. ..                                | Johnston (3)    |   |
| Order Desmothoraca.  |                 |   |
| * <i>Clathrulina elegans</i> , Cien.                           | .. ..           | Bribie Is., April, 1915.<br>Sandgate, June, 1915. |
| CLASS  |                 |   |
| MASTIGOPHORA.  |                 |   |
| SUB-CLASS FLAGELLATA.  |                 |   |
| <i>Anthophysa vegetans</i><br>(O. F. Müll.) .. ..              | Schewiakoff (1) | Brisbane. Dec., 1889.                             |
| <i>Chilomonas paramoecium</i> .<br>Ehrb. .. ..                 | Schewiakoff (1) | Brisbane. Dec., 1889.                             |
| <i>Chlamydomonas</i> .. ..                                     | Wasteneys (4)   | Enoggera.   |
| <i>Cryptomonas</i> .. ..                                       | Wasteneys (4)   | Enoggera.   |
| <i>Dinobryon</i> .. ..   | Wasteneys (4)   | Enoggera.   |
| <i>Euglena</i> .. ..   | Wasteneys (4)   | Enoggera.   |
| * <i>Euglena viridis</i> , Ehrb. .. ..                         | .. ..           | Chelmer, July, 1914.                              |
| <i>Mallomonas</i> .. ..  | Wasteneys (4)   | Enoggera.   |
| <i>Phacus</i> .. ..  | Wasteneys (4)   | Enoggera.   |
| <i>Trachelomonas volvocini</i> ,<br>Ehrb. .. ..                | Schewiakoff (1) | Brisbane. Dec., 1889.                             |
| SUB-CLASS DINOFLAGELLATA.                                      |                 |   |
| <i>Ceratium</i> .. ..  | Wasteneys (4)   | Enoggera.   |
| <i>Ceratium</i> , sp. .. ..                                    | Johnston (3)    | Enoggera, 1914.                                   |
| <i>Peridinium</i> .. ..  | Wasteneys (4)   | Enoggera.   |
| <i>Peridinium</i> , sp. .. ..                                  | Johnston (3)    | Enoggera, 1914.                                   |
| CLASS INFUSORIA.   |                 |   |
| SUB-CLASS CILIATA.   |                 |   |
| Order Holotricha.  |                 |   |
| <i>Cinetochilium murgai-</i><br><i>itaceum</i> , (Ehrb.) .. .. | Schewiakoff (1) | Brisbane, Dec., 1889.                             |
| <i>Coleps hirtus</i> , Ehrb. .. ..                             | Schewiakoff (1) | Brisbane, Dec., 1889.                             |
| <i>Coleps</i> .. ..  | Wasteneys (4)   | Enoggera.   |
| <i>Cyclidium glaucoma</i><br>(O. F. Müll.) .. ..               | Schewiakoff (1) | Brisbane, Dec., 1889.                             |
| <i>Enchelys</i> .. ..  | Wasteneys (4)   | Enoggera.   |
| <i>Nassula aurca</i> , Ehrb. .. ..                             | Schewiakoff (1) | Brisbane, Dec., 1889.                             |
| <i>Nassula</i> .. ..   | Wasteneys (4)   | Enoggera.   |
| <i>Paramoecium bursarea</i> ,<br>(Ehrb.) .. ..                 | Schewiakoff (1) | Brisbane, Dec., 1889.                             |
| <i>Paramoecium</i> .. ..                                       | Wasteneys (4)   | Enoggera.   |

# 102 RECORDED FRESHWATER PROTOZOA OF QUEENSLAND.

| SPECIES.                     | RECORDER.       | LOCALITY.              |
|------------------------------|-----------------|------------------------|
| Order Heterotricha.          |                 |                        |
| <i>Stentor polymorphus</i> . |                 |                        |
| Ehrb. .. ..                  | Schewiakoff (1) | Brisbane, Dec., 1889.  |
| <i>Stentors</i> .. ..        | Colledge (5)    | Northgate, Aug., 1910. |
| Order Peritricha.            |                 |                        |
| <i>Epistylis</i> .. ..       | Colledge (2)    |                        |
| <i>Vorticella</i> .. ..      | Colledge (2)    |                        |
|                              | Wasteneys (4)   | Enoggera.              |

My thanks are due to Dr. T. Harvey Johnston for material and valuable suggestions.

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# NOTES ON AN EXHIBIT OF A SMALL ABORIGINAL. "CAMP" COLLECTION FROM NEAR BUNDABERG.

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BY R. HAMLYN-HARRIS, D.Sc.

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*(Exhibited before the Royal Society of Queensland. November 15th, 1915.)*

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It has long been felt that our knowledge of the Stone Implements of the Queensland Aborigines is very meagre, and we have almost made ourselves believe that, beyond the proverbial stone axe, stone knife, stone millers and things of that kind and an occasional chipped flake, there is little to be found in our day, especially in those places where the natives have died out. Mr. A. S. Kenyon, of Melbourne, has, with his unique opportunities as a civil engineer, assisted by Messrs. D. J. Mahoney and S. F. Mann, subjected some of the most important places in his districts to a thorough scrutiny, and many interesting stone implements have as a consequence been brought to light. No one has as yet attempted a similar, thorough and systematic investigation of the camping-grounds in Queensland, and as a consequence many have thought that some of these crude implements found in the south are non-existent here, but from various cursory examinations of such places whenever an opportunity for field work has presented itself, I am convinced that there is yet an enormous field for investigation right throughout Queensland. Only a short time ago, through the kindness of Mr. Lionel C. Ball, of the Queensland Geological Survey, I had an opportunity of examining a number of flakes and chips collected by him in the sand dunes to the south-east of Sand Hills, near

Bundaberg. One, if not two, of these, made of jasperoid, show unmistakable secondary chipping. Snatching the opportunity of a visit to Bundaberg almost immediately after, I made a special visit to Sand Hills in company with Alderman L. H. Maynard as guide. Less than half a mile from the railway station, officially termed Barga, we came across our first feeding-ground. The sand dunes rise immediately behind the beach and within a hundred yards reach elevations of 30 to 50 feet. They are backed by low swampy ground, and this locality, judging by the many aboriginal relics of a similar rock which have been picked up from time to time and shown to me, appears to have been a favourite camping-ground. The flakes, chips, and other cutting implements found, were almost without exception accompanied by large quantities of molluscs. Through the kindness of Dr. Shirley, who identified the specimens for me, I am able to state that these heaps of shell fish consisted of the following species:—*Brachyodontes hirsutus* Lamk, *Meleagrina vulgaris* Schn., *Nerita chameleon* L., and a species of oyster. So that the camp collection which we made on the spot consisted of these shells, together with one blank (unfinished) axe of silicified sandstone, two primitive stone tools also made of the same material, a large quantity of flakes, chips, scrapers, drills and gouges made of silicified sandstone, jasperoid, petrified wood, quartz, etc., and a basalt hammer. The latter implement has most distinct finger marks, and although it was made of basalt, an unusual material for an implement of this kind, a definite weathered surface of that portion used in hammering testifies, I think, to its one time use. The country rock here is of vesicular basalt which, as Mr. Ball has pointed out, was evidently considered unsuitable for tool making. He considers that the Burrum coal measures presumably underlie the basalt, but they do not appear on the surface in this locality, so we may presume that the silicified rocks used by the aborigines as here described, had evidently been brought some distance by them for this purpose.



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# THE VOLCANIC ROCKS OF SOUTH-EASTERN QUEENSLAND.\*

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(Read before the Royal Society of Queensland,  
November 15th, 1915.)

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## I. INTRODUCTION.

DURING the last forty years, there have been numerous publications dealing with different portions of the volcanic area of south-eastern Queensland, or with some representatives of the volcanic rocks, but hitherto there has been no attempt to deal with the volcanic area as a whole from a petrological standpoint.

Many divergent views have been put forward as to

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\*The Council of the Royal Society of Queensland desires to acknowledge its gratitude to the Queensland Government for their generosity in printing this paper.

the age of the volcanic activity, and the field occurrences of the rocks in a few of the localities have been described. Dr. H. I. Jensen has thoroughly dealt with the alkaline representatives, and as a result they have gained a rather undue prominence, for it is found that they form quite a minor portion of the extensive development of volcanic rocks in the area.

The calcic or sub-alkaline rocks have received scant attention, and microscopic and chemical investigations have been, with the exception of the Main Range district, restricted almost entirely to the alkaline rocks.

The area under investigation covers about 4,000 square miles, and is in the extreme south-eastern corner of Queensland. It is bounded by the Pacific Coast on the east, by MacPherson's Range on the south, by the Main Range on the south-west and west, and on the north by an east and west line from Toowoomba to the coast. In addition to this main area, the strip of country between the coast and the D'Aguilar Range as far north as the Glass House Mountains, and the Brisbane River Valley as far north as Esk, are added.

During the last five years the author has travelled extensively over this area, more particularly, however, in the southern portion which is the least known geologically. All the important localities have been investigated. Altogether twenty-five complete analyses<sup>1</sup> of volcanic rocks of this area have been recently made in the laboratory of the Agricultural Chemist, and these analyses, together with nine published by Dr. Jensen,<sup>2</sup> furnish analyses of all the important rocks. Thus it is possible to enter upon a correlation of the various types on chemical lines.

Owing to the absence of any important development of fossiliferous rocks since late Mesozoic times, physiological considerations must be availed of in elucidating the Cainozoic history of this area.

The physical features are so largely connected with the origin and structures of the volcanic rocks that an

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<sup>1</sup> Ann. Rept. Agric. Chem., Q'land, 1912, 1913, 1914.

<sup>2</sup> Proc. Linn. Soc., N.S.W., xxxi-xxxiv. (1906-1909).

investigation of the latter is essential before anything definite can be arrived at with regard to the history since late Mesozoic times.

As has been pointed out by E. O. Marks,<sup>3</sup> the problem of the geological ages of volcanic activity affects extensive areas of coal measures, for by far the greater portion of this area is made up of the Mesozoic coal-bearing sediments.

A great portion of the area dealt with is still covered with its dense virgin scrub, and this, coupled with the size of the area and the extreme ruggedness of a great deal of it, has rendered it impossible to prepare anything other than a geological sketch-map, roughly showing the distribution and extent of the various rocks.

The accompanying sketch-map, however, in a general way, indicates the areas which are at present occupied by volcanic rocks and, taken in conjunction with the various sketch-sections, affords a reasonable idea of the extent, distribution, and stratigraphic relationships of the rocks of the area.

The main questions which the author has set out to determine are:—

A—The relationships of the volcanic rocks—

(a) to one another;

(b) to the sedimentary and metamorphic rocks.

B—The geological period at which these rocks have been extruded.

## II. PREVIOUS LITERATURE.

E. O. Marks, in his paper<sup>4</sup> "Notes on the Geological Age of Volcanic Activity in south-east Queensland," has summarised the various views put forward, up to that time, as to the age of the volcanic activity, and he also gave a list of publications particularly bearing on the volcanic area.

Since then, however, there have been one or two further contributions: and as it is proposed to discuss in

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<sup>3</sup> Proc. Roy. Soc., Q'land, vol. xxiii., pt. 2 (1912), p. 139.

<sup>4</sup> Proc. Roy. Soc., Q'land, vol. xxiii., pt. 2 (1912).

this paper many of the views put forward by previous writers as to the extent and age of the volcanic rocks, a résumé of the conclusions drawn by the several investigators is desirable.

A. C. Gregory, in 1875 and 1879, referred the basaltic rocks in this area to a very recent date in the Tertiary era. W. H. Rands, in 1887 and 1889, placed the Brisbane tuffs at the base of the Trias-Jura; the Woodhill trachyte as contemporaneous with what are now called the Walloon or uppermost Trias-Jura measures; and the Tamborine Plateau and MacPherson's Range basalts and andesites as older than the Desert Sandstone (Upper Cretaceous). Rands regarded a certain deposit at the head of the Nerang River as being of Desert Sandstone age, but this, as shown further on, the author believes to be really rhyolitic pyroclastic material which has been found extensively developed in that area, and resting usually upon underlying basalt flows. In 1902, Dr. Jack was of the opinion that the basalts of the Main Range at Toowoomba, and also the Ipswich basalt, were contemporaneous with the Trias-Jura rocks in each of these places, but that the basalts at Clifton on the Darling Downs were younger than the Trias-Jura.

In 1898, S. B. J. Skertchly referred to the Toowoomba basalts as Tertiary in age. H. I. Jensen, in several papers in the Proceedings of the Linnean Society of New South Wales and elsewhere during the period 1906-1909, dealt fully with the alkaline rocks of the Glass House Mountains, and the Mount Flinders-Fassifern areas. He showed that the alkaline trachytes &c., intruded the Upper Trias-Jura, and, on account of their similarity with the Warrumbungle rocks, he set the Queensland rocks down as early Tertiary—Eocene or Lower Miocene. He also considered the South Queensland basalts Pliocene in age.

E. C. Andrews, in 1903, set down the (?) trachytes and basalts of MacPherson's Range district as Trias-Jura in age, but he has subsequently withdrawn this, and is now inclined to view them as Tertiary in age.

Wearne and Woolnough,<sup>5</sup> in 1911, described the occurrence of the rhyolites, trachytes, andesites and basalts

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<sup>5</sup> Proc. Roy. Soc., N.S.W., xlv., p. 137.

in the south-western portion of the area, and determined the volcanic sequence as—i. Trachytes, ii. Andesites and dacites, iii. Rhyolites, iv. Basalts; while they believed the ages of the volcanic eruptions to belong (i.) to the Walloon stage of the Trias-Jura Coal Measures &c., (ii.) to the Tertiary Era.

E. O. Marks, in 1910 and 1911, in referring more particularly to the basaltic types of south-east Moreton, set down one series, composed particularly of the andesites and basalts of MacPherson's Range and the Tamborine Plateau, as Trias-Jura, and another series, exemplified by the basalts near Brisbane, as late or post-Tertiary. The same writer in 1912<sup>6</sup> strongly favoured a Trias-Jura age for the trachytic rocks in the Esk district.

In 1913,<sup>7</sup> R. A. Wearne gave further evidence for the Trias-Jura age of a portion of the volcanic rocks of the area.

Microscopic investigations have not been carried out previously on the sub-alkaline rocks, except on a few rocks by Dr. Woolnough from the locality of Cunningham's Gap, and a few by Dr. Jensen; while chemical investigations have been, hitherto, almost entirely restricted to the alkaline rocks.

With respect to the time at which these volcanic rocks have been extruded, we find Rands, Jack, Wearne, and Marks have advocated a Trias-Jura age for either all or a part of the volcanic series, whereas A. C. Gregory, Skertchly, Jensen, and also Andrews of recent years have advocated a Tertiary age for the rocks they have particularly described.

No previous record has been made by any of the writers on this area of the threefold development of upper, middle, and lower divisions of volcanic rocks which the author has found developed extensively over a great part of the area.

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<sup>6</sup> Queensland Govt. Min. Jour., xiii. (1912).

<sup>7</sup> A.A.A.S., xiv., Melb. 1913.

## III. PHYSICAL FEATURES.

A general examination of the map of the area concerned shows certain marked features with regard to the drainage (*see* Plate X.).

It is noticeable that MacPherson's Range on the south, and the Main Range on the south-west and west, form very definite water-divides. With respect to MacPherson's Range, on the Queensland side all the drainage is to the north and north-east, there being a marked parallelism of the valleys. In fact, the characteristic feature is the northerly trend of the drainage until the wider valleys in the volcanic-rock-free portions of the Mesozoic measures are reached, when there is a marked easterly trend.

The main factor governing this northerly trend is the general north and south direction of the ranges forming the divide between the streams. An investigation of these ranges leaves little doubt as to their being residuals, except, perhaps, in the case of some of those in the western part of the area. They are either at present capped with volcanic rock, or show signs of having been covered at one time, and one is inclined to the belief that the pre-volcanic drainage system had a general north and south direction and that the north and south ranges of to-day mark the sites of the former valleys, or else that, as a result of folding movements, there was formed a series of depressions extending in a general north and south direction. The field evidence is very much against the latter.

Wearne and Woolnough<sup>s</sup> have shown that in Cainozoic times the divide which is now constituted by the Main Range was considerably to the east of its present position, and that there are traces of several stream channels along which the streams flowed in a westerly direction.

The only evidence of extensive faulting is in the western part of the area, and the same authors have shown the influence of this which has resulted mainly in the steep escarpment along the eastern slope of the Main Range.

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<sup>s</sup> Proc. Roy. Soc., N.S.W., xlv.

The most prominent features of the area are, perhaps, the plateaux capped with basic volcanic rocks in the south. One finds there the extensive plateaux known as Lamington, Roberts, Springbrook and Tamborine Plateaux. While slightly undulating on the surface, the first three plateaux rise gradually to the south, and on the border the culminating peaks are approximately 3,500 feet high, while Tamborine plateau is only 2,000 feet high. There is little doubt that they were at one time all connected. They are, however, very much dissected by the head waters of the Logan, Albert and Nerang Rivers and in the upper portions of the streams great canyons with almost precipitous sides and nearly 2,000 feet deep in some places occur.

All along the south-west and west parts of the area, one finds the basalt-capped plateau which constitutes the eastern edge of the Darling Downs, and at a height of approximately 2,500 feet. The main portion of the area is occupied by the slightly undulating Mesozoic plains which are traversed by sandstone ridges in a north and south direction. These are now either capped with volcanic rocks, or show signs of having been covered at one time. The valleys are wide and very deeply filled with alluvial material derived from the volcanic-capped plateaux at the heads of the streams. The outstanding masses of acid and sub-acid rocks form a conspicuous feature, and a close similarity of appearance characterises these masses, *e.g.*, Mounts Lindsay, Barney, Maroon, Edwards, Greville, Flinders &c., and the various peaks of the Glass House Mountains. These masses range from 4,600 feet above sea-level in the case of Mount Barney, to small hillocks. The contrast between these peaks of rhyolitic and trachytic rocks, and the plateaux of andesitic and basaltic rocks, is most marked. The western part of the area is bounded by a basalt-capped plateau at a height of about 2,500 feet above sea-level, but which has along it several peaks about 4,000 feet high—namely, Mounts Wilson, Roberts, Huntley, Spicer, Mitchell, Cordeaux, Castle &c. On the eastern side, along the coast, there is a broad coastal plain only a few feet above sea-level, extending from near Point Danger to well north of Southport. This is here and there dotted by inliers of Palæozoic schists,

while at Currumbin and Burleigh Heads there are ridges of Palæozoic rocks, in some cases capped by basaltic rocks, dividing the plain.

The drainage of the various plateaux in the south usually descends over precipitous cliffs, often 500 feet or more in height. These falls are very frequent, and the head of each creek generally has its falls several hundreds of feet high. The course of the stream is then usually through a canyon-like valley with precipitous cliffs, in some cases 2,000 feet high, on either side; and the valley itself may be only half a mile wide. This young valley usually merges suddenly into a mature and well-rounded valley immediately the plateau is traversed and the Mesozoic sediments without a capping of volcanic rocks are entered upon. The contrast between the valleys dissecting the plateaux of volcanic rocks, and the valleys in the denuded Mesozoic areas, is very pronounced, and is, no doubt, almost entirely due to the differential rates at which the rocks are worn down.

The streams flowing over the Mesozoic portion of the area are very similar in nature, and their maturity is very evident. If one views a valley such as the Reynolds' Creek Valley from Mount Greville or the Canungra Creek Valley from Tamborine Plateau, the serpentine-like line made by the dark vegetation which grows on the banks of the streams is very definite. The average fall of the streams when once they have left the plateau area is approximately 5 feet per mile.

The steep cliffs which frequently form impassable precipices around the plateaux are due in many cases to the undercutting of the loosely-aggregated acid volcanic agglomerate and tuff. This acid fragmental rock is usually near the lower level of the cliffs, and owing to its ease in wearing away, it leaves no support for the overlying hard basic volcanic rocks which consequently fall away leaving steep inaccessible cliffs.

All of the plateaux are of the same structure. They are made up of a lower series of sub-basic and basic rocks resting on either Palæozoic or Mesozoic sediments; on top of this, one finds either acid tuff, agglomerate, or lava, and

resting on this, numerous flows of sub-basic and basic rocks. The upper series may contain twenty or more different flows, and individual flows may attain a thickness of 100-120 feet, though usually they are much less than this. These separate flows result in a series of ledges being formed along the cliff faces.

In the south-eastern part of the area, even in the areas free from volcanic rocks, the topography is very young and this is especially so in the upper parts of Little Nerang Creek, Mudgeeraba Creek, and Currumbin Creek. The youth of the valleys results from the resistant character of the Palæozoic schists, and is contrasted very sharply with the mature valleys of the streams in the areas of Mesozoic sediments.

The relationship between the vegetation and the rocks is a very striking one. The volcanic rocks are usually clothed with scrub, the sub-basic and basic rocks being thickly coated with true scrub, and the acid and sub-acid rocks with either bastard-scrub or forest timber. The Mesozoic and Palæozoic rocks are clothed with the normal forest timber. The value of selections on rhyolitic country is not nearly as high as that of selections on andesitic or basaltic country, although all other conditions may be similar. The part which the volcanic rocks have played in the production of the soils of the rich valleys of this area is, of course, very great, and a close relationship between the fertility of the soil and the rock is observable.

#### IV. EARTH MOVEMENTS.

Dr. Jensen<sup>9</sup> has discussed the faulting near Mount Flinders and west of Ipswich, while Wearne<sup>10</sup> and Woolnough have shown the extensive faulting which has gone on in the western and north-western portions of the area. The author has obtained evidence which is in general accord with the conclusions arrived at by these investigators. Just to the north of Brisbane near Albion, a fault line in a north and south direction is known, but this is of no great importance.

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<sup>9</sup> Proc. Linn. Soc., N.S.W., xxxiv., p. 68.

<sup>10</sup> Op. cit., pp. 140, 141.

Apart from the above instances, no important fault movements are known to have occurred.

Folding movements of only a very gentle nature have taken place since the Palaeozoic era.

The earth movements might then be regarded as being of a vertical nature, and the important ones have taken place in the western and north-western parts of the area, along lines having a general north and south direction.

These movements took place in Cainozoic time and the last great movement occurred after the volcanic activity had ceased for some time.

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## V. VOLCANIC ROCKS.

### (I.) GENERAL PETROLOGY.

The maximum thickness of volcanic rocks in any one area is approximately 3,000 feet, and this is seen to be made up in general of three main divisions, the lower basaltic members, the middle rhyolitic and trachytic members, and the upper basaltic and andesitic members. The upper division has the greatest development and the lower division the least.

This maximum thickness of 3,000 feet does not occur only in isolated places, but is general along MacPherson's Range, and in parts along the Main Range. The southern plateaux have an average elevation of approximately 2,500 feet, with volcanic deposits about 2,000 feet thick.

Tamborine Plateau, however, has an average thickness of about 800 feet of volcanic rock; Springbrook Plateau has about the same but rising to a thickness of 1,000 feet at least at its southern termination.

Lava flows exist at all levels from the sea-level at Lytton, Wellington Point, Point Danger &c., to over 4,000 feet in the south and west. An examination of the map shows that the present-day development is particularly in the south and the west, but there is very strong evidence of the development having been very much more extensive both to the north and east of the present main masses. In

all probability there was a connection between the Tamboorine Plateau and MacPherson's Range, and also a general extension in a westerly direction to Mount Lindsay. The length of time over which the volcanic activity resulting in these deposits extended must have been considerable, for in many cases the formation of soil on the surface of the flows has taken place, and in others river gravels and lacustrine deposits have been formed before the succeeding flow has been poured out.

There seems to have been a decided lapse of time between the extrusion of the lower and middle divisions of rocks, for in the Lamington area the acid agglomerate belonging to the middle division rests on extremely weathered basaltic material, and incorporated in the acid agglomerate are lumps of underlying soil. The same holds good between the middle and upper divisions.

In the Upper Chinghee Creek area, a deposit of river gravel several feet thick, containing well-rounded pebbles of the underlying basalts and rhyolites, occurs between the rhyolite and the overlying basalts. The upper division is made up of a large number of flows, and there are abundant instances in many localities of the production of surface soils before the succeeding flow took place. In some cases there are stems and roots associated with the soil, and in other places deposits of diatomaceous earth, between successive flows of lava, as at Mount Meerschaum, Beech Mountain, Point Danger, &c.

The total amount of denudation which has gone on since volcanic activity ceased has been very large, and valleys have been carved out to a depth of 2,500 feet—*e.g.*, the Christmas Creek Valley—through the volcanic rocks. In other places, as in Canungra Valley, there has been a cutting down through 1,000 feet of volcanic rocks, and through 700 feet of Mesozoic sediments, giving to-day a stream with a very meandering nature. At Cunningham's Gap also, the volcanic rocks had been denuded at least 1,500 feet, giving a well-rounded valley before the faulting along a north and south direction, which resulted in the so-called air-gap, took place. It is thus quite clear that

the volcanic activity extended over a lengthy period, and also that there has been considerable time since the last volcanic outburst.

The extrusions appear to have been poured out under sub-aërial conditions, for nowhere in the area is there any evidence of marine deposits, but on the other hand, one has the occurrence between the flows, of soils *in situ*, of river gravels, of deposits of diatomaceous earth, and of the lacustrine Oxley beds which directly underlie the basalts at Cooper's Plains, and the trachytic rocks at Redbank Plains. The volcanic rocks show great variation in types, and they range from rhyolites to basalts. Rhyolites, trachytes, andesites and basalts are all abundantly represented though rhyolites and basalts seem to have the greatest development. Pitchstones and obsidians are associated with the rhyolites. In addition to the normal lavas, there are tremendous accumulations of pyroclastic material.

In considering the alkaline or sub-alkaline nature of the rocks it is found that there is a definite series having alkaline characteristics, but the great majority are definitely sub-alkaline. The terms alkaline and sub-alkaline are used all through as the equivalents of the terms "atlantic" and "pacific" as used by Harker. In addition to these two series, a third series which has characteristics intermediate between those of the alkaline and sub-alkaline series is developed to a minor extent.

Deposits of fragmental material are common in many parts of the area, but the greatest development of these is in association with the acid members. In the Lamington Plateau area in particular, basaltic agglomerate is associated with the lower basic rocks, while on the Main Range at Spicer's Peak, and in particular at Toowoomba, there are fragmental deposits associated with the basic rocks. At the latter place the development of basic tuff exceeds that of any other part of the area. While fragmental rocks among the lower and upper basaltic series are localised, there is a widespread distribution of acid and sub-acid fragmental material, especially of the former, over an area of 300 square miles right in the south.

Apart from the fragmental material, however, very extensive deposits of lavas of basic, intermediate and acid natures occur. The most widespread distribution of lavas is with the andesites and basalts belonging to the upper division.

*The lower division*, made up of basic and sub-basic rocks, is very widespread, being found over almost the whole area in the south and south-west, which is at present covered with volcanic rocks. The greatest development is at Mount Lindsay where it has a thickness of at least 1,500 feet, but usually it is less than 100 feet thick.

*The middle division* is made up of rhyolites and trachytes together with their glassy and fragmental representatives. As far as extensive development is concerned, the rhyolites are confined to the southern portion extending over an area bounded on the south by MacPherson's Range, while the trachytes occur in the south-west, generally along the line of the Main Range. However, trachyte is found in the southern area at Cainbale Creek, and rhyolite in the south-western area at Mount Alford. A remarkable similarity exists between the fragmental deposits all over the southern area, and not only is this confined to the actual nature of the material and its included fragments, but also to the manner in which it occurs and weathers. The acid lava is found either above or below the volcanic agglomerate, though on the Springbrook Plateau, where there is a widespread distribution of both lava and fragmental material, the lava occurs with agglomerate both above and below. In the Main Range area at Spicer's Gap, the agglomeratic and tuffaceous trachytic material appears to be above the trachytic lava.

The thickness of this middle division may be 1,000 feet, as is the case at the Springbrook Plateau. At this place the rock is rhyolitic and not more than 200 feet is fragmental.

*The upper division*, of sub-basic and basic rocks, is made up of a very large number of separate flows amongst which, in the same locality, there may be considerable variation.

One may have, as at Tamborine Plateau, fine-grained

basalts, olivine-basalts and porphyritic andesites resting on one another, or at Lamington Plateau, a series of about twenty different flows of basalt. The individual flows vary greatly in thickness, in vesicular nature and in texture; in addition to this, they do not seem to be very persistent, but rather to overlap one another. The maximum thickness of the upper division is approximately 2,000 feet.

Pyroclastic material does not occur in this upper division throughout the southern plateaux, but on the Main Range one finds it on top of Mount Spicer in the form of agglomerate, and at Toowoomba there is a most extensive development of tuff. Basalt is much more widespread than andesite, and the greatest development of the andesitic type occurs in the east and south-eastern portions of the area, while the southern and western portions are almost entirely basaltic and usually rich in olivine; this is particularly the case at Toowoomba.

#### *Nature of Extrusions and Sequence of Flows.*

All three divisions are widespread, and there is a good deal of variation in the thickness in different localities. The acid and sub-acid members occur in the middle division; the lower and middle divisions are characterised by abundant pyroclastic material; while the upper division, except in one or two isolated and widely distant localities, has no development of pyroclastic material, but is built up of a large series of flows none of which attain any very great thickness. It is clear that the upper division at least was characterised by a tranquil welling out, such as characterises fissure-eruptions, and preceding this period, during which such a tremendous amount of volcanic material was quietly effused, there was one of violent outburst giving the large accumulations of acid volcanic agglomerate and tuff. This period of explosive violence must have been a fairly extensive one or else it was most prolific in the production of material. There is a remarkable similarity throughout the whole of the southern area, where the acid agglomerate is particularly developed, in this pyroclastic material; and the uniformity of nature and the widespread distribution incline one to the view that there must have been a large number of

volcanic vents from which the material was showered forth at the same time. One of the characteristic included fragments in the agglomerate is a black pitchstone containing abundant white felspar phenocrysts, and it is an exception to find any occurrence of the agglomerate without fragments of this material. The only source of this pitchstone actually encountered was Mount Lindsay, yet it characterises agglomerates at least 36 miles away. Associated with the acid agglomerate, extensive flows of rhyolite are found particularly in the south-eastern portion of the area. The highly-fluxioned lithoidal rhyolite of the Springbrook Plateau and Tamborine Plateau differs from the porphyritic rhyolite met at Upper Chinghee Creek and the less porphyritic but more glassy type near Mount Lindsay, so that one does not find the same similarity of lavas as of pyroclastic material. The Chinghee Creek and Mount Lindsay material can each be reasonably ascribed to two closely adjacent volcanic vents, while the fine-grained more fluxioned and more extensive acid flows in the south-east of the area are most likely derived from a fissure or series of fissures with a general north and south extension.

Associated with the trachytes of the Main Range, as at Mount Roberts and near Spicer's Gap, there is fragmental material, and while there has been a quiet welling out along a north and south set of fissures of the trachytic material, as well as explosive outbursts, there is a series of plugs characteristic of the central type of eruption in a general north-east and south-west direction from the Main Range to Mount Flinders. It is probable that also during this period the rhyolitic and trachytic rocks were formed in the Esk and Glass House Mountains districts.

The material of the lower division appears to have resulted rather from fissure eruptions than from central vents, for although there is at Christmas Creek a development of agglomerate, the general uniformity of the lava and its widespread distribution taken into conjunction with its comparative thinness point towards a series of fissures forming the channels for the effusion.

It is a somewhat difficult matter to determine the sequence of the various volcanic products over the whole

area, but in a general way the order can be established. Volcanic activity seems to have been ushered in with the extrusion from fissures of a normal basalt; this was succeeded by olivine-basalt. The latter portion of the period was characterised by explosive action in certain isolated localities, and may have been due to the choking of the fissures. This ended the first period of activity. After some time the intensely explosive action marking the second period developed and large deposits of rhyolitic agglomerate containing fragments of rhyolite and pitchstone were hurled out, to be succeeded in certain centres by lava flows of an acid nature, these being succeeded by the volcanic agglomerate again. The ashy material in some few localities was deposited in water and tuff resulted, but the occurrence of bedded ashy material is very limited. While the acid material was being extruded in the southern portion of the area, sub-acid ashes and lavas were being extruded in the south-west and generally along a north-east and south-west line to Mount Flinders. Dr. Jensen,<sup>11</sup> in dealing with the Mount Flinders and Fassifern areas, pointed out this probability. Most of the material during this period was extruded through vents of the central type, though the trachytes along the Main Range were probably the result of fissure eruptions.

Succeeding this period of activity, which was characterised by such prolonged and intense explosive action, there was the third period during which a vast accumulation of basic and sub-basic rocks was poured out. Generally speaking, the operations of this period seem to have been of a tranquil nature, and the material to have been extruded through a large number of fissures. Olivine-rich basalts are the predominant lavas of this period, but there is in the south-eastern portions of the main area, and also in the south-eastern coastal area, a development of andesitic rocks. These seem to have been extruded at an early time in this third period, but in almost all cases basalts or olivine basalts were first poured out. The final extrusions were almost all of a rather basic nature, and olivine basalt is characteristic of the uppermost flows. The

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<sup>11</sup> Proc. Linn. Soc., N.S.W., xxxiv. (1909), p. 72.

explosive element seems to have become more pronounced towards the end, and the extrusions were apparently carried out through vents of the central type, and accompanied by moderate explosive action except at Toowoomba, where it seems to have been particularly violent. The sequence from below upwards might then be stated as follows:—Normal sub-alkaline basalts followed by olivine-basalts, then the normal rhyolites, trachytes and the various alkaline lavas; these in turn were succeeded by olivine-basalt, andesite, andesitic basalt and olivine-basalt, generally speaking in that order.

*Comparison with Cainozoic Volcanic Rocks of New South Wales and Victoria.*

When one compares the threefold development of volcanic rocks in this area with the Cainozoic volcanic rocks of New South Wales and Victoria, a most interesting correlation is seen. In New South Wales there is a considerable development of older sub-alkaline basalts which rest upon leaf beds which are considered to be of early Cainozoic age, and these older basalts are especially developed in the New England district. A series of alkaline lavas and tuffs occurring in the Canoblas, Warrumbungle, and Nandewar regions is, in part at least, ascribed to the Upper Miocene,<sup>12</sup> and the remarkable similarities between many of these lavas and those of south-eastern Queensland have been pointed out by Dr. Jensen. In addition to these two developments, there is a series of newer sub-alkaline basalts at Ben Lomond, Gulgong, Inverell &c., which are regarded as probably Pliocene.

In Victoria<sup>13</sup> an older and a newer series of sub-alkaline basalts, belonging to the Lower and Upper Cainozoic respectively, occur, and also a development of alkaline lavas which are mainly trachytic and in many respects very similar to the alkaline types from this area. This alkaline series is believed to be of Middle Cainozoic age, and is certainly older than the newer series of sub-alkaline basalts.

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<sup>12</sup> T. W. E. David, N.S.W. Handbook, B.A.A.S., 1914.

<sup>13</sup> E. W. Skeats, A.A.A.S., vol. xii., 1909.

A tabulated comparison is given in the next chapter.

It is interesting also to note that J. A. Douglas,<sup>14</sup> in a paper on "Geological Sections through the Andes of Peru and Bolivia," points out that after the intense folding and elevation which took place in Middle Tertiary times, resulting in the raising of the Andes, volcanic activity continued and vast sheets of rhyolitic lavas and tuffs were poured out, and these were succeeded by the trachytic lavas which build up Mount Taapaca and the andesites and basalts of Mount Tacora and Chupiquiña.

## (II.) AGE OF EFFUSIVE ROCKS.

The acid pyroclastic material near Brisbane known as the Brisbane Tuff<sup>15</sup> is unquestionably at the base of the Ipswich Series of Coal Measures, and there is no doubt as to its early Trias-Jura age. Apart from this minor occurrence, however, the most recent opinions expressed by writers, namely E. O. Marks and R. A. Wearne, on the volcanic rocks of this area have been certainly in favour of a late Trias-Jura age for at least a considerable portion of the extruded material. The author, after a most careful investigation into all the evidence adduced in favour of these opinions, is unable to accept them, but, on the other hand, is convinced of a post-Walloon age for the whole development. If the Walloon measures represent the uppermost Trias-Jura deposits, then the whole volcanic development is post-Trias-Jura. All the direct and indirect evidence appears undoubtedly to point in this direction, and Messrs. Marks and Wearne, who have been the most ardent advocates of an Upper Trias-Jura age for a great deal of the volcanic material, have accepted the author's interpretations of the sections and occurrences which had formerly chiefly led them to their conclusions.

The volcanic rocks are found resting on top of the Trias-Jura sediments in all parts of the area, except in the south-east, where they rest on the Palæozoic schists. In no

<sup>14</sup> Q.J.G.S., vol. lxx. (1914), pp. 47, 48.

<sup>15</sup> W. H. Rands, Q'land Geol. Surv., Pub. 34.

locality is there any interbedding of the volcanic flows or pyroclastic material with the Mesozoic sediments, but on the other hand there is abundant evidence of inclusions of the Mesozoic sediments in the overlying volcanic rocks. Rhyolitic pitchstone, trachytic and basaltic dykes and sills intrude the Walloon Coal Measures in different localities.

In several places, deposits of diatomaceous earth a few feet thick occur between successive flows of basalt in the upper division of volcanic rocks. These deposits occur at Mount Meerschaum, Beech Mountain, Tweed Heads, near Rosewood &c. In some cases the diatomaceous material has been altered into common opal,<sup>16</sup> but where it is unaltered frequent traces of plant-remains are found. These remains are imperfectly preserved and not capable of precise determination, but amongst them remains of dicotyledonous plants can be recognised; this places these basaltic flows as post-Trias-Jura at least. In the middle division of acid and sub-acid rocks abundant fragments of the Mesozoic sediments occur. The most notable example is in a small cliff section in Upper Christmas Creek, between portions 62v and 72v. Here, a mass of shale many feet in diameter is included in volcanic agglomerate. The shale is standing with its bedding approximately vertical and it contains not only a highly carbonaceous band, but also fossiliferous shale bands containing *Cladophlebis* which characterises the Upper Trias-Jura measures of this locality.

An examination of this section leaves no doubt whatever as to the included nature of the mass of shale, and it furnishes definite evidence of a post-Walloon age for this volcanic material. The compactness and nature of the material in the shale-block indicate that a considerable period of time had elapsed between its formation and the disruption from the bedded position.

The basalts of Cooper's Plains and the trachytic material at Redbank Plains both overlie the Oxley beds as shown by Marks<sup>17</sup> and Cameron. The Oxley beds which

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<sup>16</sup> Q'land Mineral Index, Q'land Geol. Surv., Pub. 241, p. 961; E. W. Skeats, Proc. Roy. Soc., Q'land, xvi. (1914).

<sup>17</sup> Q'land Geol. Surv., Pub. 225 (1910), p. 53.

contain remains of dicotyledonous plants, fish, and reptiles are most probably Tertiary, though they may be Cretaceous. In any case these occurrences of volcanic rocks are certainly post-Trias-Jura and most likely Cainozoic in age. There seems to be a definite connection between the trachytic material of the Redbank Plains and that along the line of eruption from Mount Flinders to the Main Range, so that there is additional evidence of a post-Trias-Jura age for the middle and upper divisions of the volcanic rocks at least. It will be noticed that all the direct evidence as to age is based on fossil leaves with the exception of the Oxley beds which in addition to dicotyledonous plants contain fish and reptilian remains. As to the latter beds, the question of age is merely one between the Cretaceous and Cainozoic. The direct evidence is thus seen to point to a Cainozoic age for the whole development.

The indirect evidence, obtained from a correlation of these rocks with similar ones in New South Wales and Victoria, is seen to be in accord with the above, and the following table shows an interesting comparison between the developments in the three States.

| Cainozoic Volcanic Rocks of New South Wales. <sup>1</sup>                             |                     | Cainozoic Volcanic Rocks of Victoria. <sup>2</sup> |                    | Cainozoic Volcanic Rocks of South-east Queensland.  |                    |
|---|---------------------|--|--------------------|---|--------------------|
| —   | Age.                | —  | Age.               | —   | Age.               |
| Basalts of Ben Lomond, Inverell, Gulgong &c.  | Probably Pliocene   | Newer basalts ..                                   | Upper Cainozoic    | Upper division of basaltic rocks  | ? Upper Cainozoic  |
| Alkali lavas and tuffs of the Canoblas and Warrumbungle Mountains and Nandewar Ranges | Upper Miocene       | Alkali series of Central and Western Victoria      | ? Middle Cainozoic | Middle division of acid and sub-acid rocks, including the alkaline series of the Main Range, Fassifern, Mount Flinders, and Glass House Mountains | ? Middle Cainozoic |
| Older basalts typically developed in New England District                             | Oligocene to Eocene | Older basalts ..                                   | Lower Cainozoic    | Lower division of basaltic rocks  | ? Lower Cainozoic  |

(<sup>1</sup>) T. W. E. David, N.S.W. Handbook, B.A.A.S. 1914, p. 603.

(<sup>2</sup>) E. W. Skeata, A.A.S. xii, 1909, pp. 199 et seq.

As E. O. Marks and R. A. Wearne, the most recent writers on the age of the volcanic activity resulting in these rocks, have so definitely advocated a Trias-Jura age for at least a considerable portion of them, the author has found it necessary to deal with this matter rather fully. Marks writes<sup>18</sup>:—

“ The present writer in examining the coal-measures south of Brisbane came to the conclusion that the volcanic rocks met with, almost entirely of the basaltic type, belong to two ages, Trias-Jura and late or post-Tertiary. In a flying visit to the coal-seams outcropping on the Upper Logan district, a site was pointed out by Mr. Buchanan, where an outcrop of carbonaceous shale or weathered coal had been covered by a recent slip in the bank of Christmas Creek. Mr. Buchanan remarked on the outcrop being perpendicular, and the writer observed that the sandstone in juxtaposition with the fallen ground was also perpendicular, and that this sandstone contained rounded pebbles of basalt similar macroscopically to the andesitic basalt of the neighbourhood. Some distance further down the creek, a similar sandstone is seen resting on the basalt. Owing to circumstances, a detailed examination could not be made then, but the section thoroughly convinced the writer of the Trias-Jura age of the basalt in that locality. . . . The sandstone and included basalt is presumably on the same horizon as that observed by Mr. Rands, and ascribed by him to the Desert Sandstone. . . . It is more than probable, there being no evidence to the contrary, that the sandstone observed by Mr. Rands is of Trias-Jura age, like the remainder of the sandstone in the neighbourhood.”

It was the above that mainly led Marks to a Trias-Jura age for most of the basaltic rock, more especially for that in the eastern portion of MacPherson's Range. The cliff section pointed out by Mr. Marks was the one already described by the author earlier in this paper (*see*

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<sup>18</sup> Proc. Roy. Soc., Q'land, xxiii, pt. 2, p. 142.

page 123). and there is no doubt that the "sandstone" in juxtaposition to the fallen ground which contained pebbles of andesitic basalt is in reality the acid pyroclastic material which occurs developed to such an extent in that area. There is absolutely no trace of included fragments of volcanic rock in the mass of included shale, but the volcanic fragmental rock which surrounds it is thickly strewn with both rhyolitic and basaltic fragments, some of which attain several inches in diameter. The so-called "similar sandstone" further down the creek is also the acid pyroclastic material. I have communicated with Mr. Marks who is now in Dublin, and he quite accepts my interpretation, indicating also that he did not have a proper opportunity of thoroughly investigating the section. He writes: "The fact that the upturned strata are only part of a comparatively small mass enclosed in the tuff is an unexpected explanation of the section which I could only explain by contemporaneous action. It is very interesting and of course accepted, and removes the only definite evidence I saw of contemporaneous vulcanicity."

The material called desert sandstone by the late Mr. Rands,<sup>19</sup> and which forms the summit of the ranges between Nixon's Creek and Back Creek, is also the acid pyroclastic rock.

It is somewhat remarkable that both Rands and Marks should have regarded this material as sandstone, but the author of this paper is quite convinced of the real nature of the material as he has had repeated opportunities of investigations in innumerable cliffs, distributed over a large area, and has also investigated micro-sections (*see* Plate XIII., fig. 3) of the more compact material.

It is thus clear that Mr. Rands' pre-Cretaceous age for the basalt underlying the acid agglomerate and acid tuff at Nixon's Creek and Nerang Creek is not borne out on the evidence.

Mr. Rands described the Woodhill trachyte as a flow interbedded with the Walloon measures, but the true relationship is masked by faulting, and one needs to assume

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<sup>19</sup> Q'land Geol. Surv., Pub. 51 (1889).

less in interpreting it as a sill than as an interbedded flow. The material is very much weathered and is probably a sill connected with the trachytic mass at Mount Flinders.

The evidence put forward by Wearne<sup>20</sup> for a Trias-Jura age for some of the volcanic rocks is here summarised and is as follows:—

- (1) Occurrence of waterworn volcanic pebbles in beds of conglomerate, near the top of the Walloon series. These pebbles have been found near Mount Flinders, near Mount Alford, in Blenheim Creek and near Esk.
- (2) Occurrence of a piece of volcanic tuff containing imprints of Trias-Jura plants and associated with basalts at the Hip Roof Range, south of Laidley.
- (3) Occurrence near Esk of volcanic tuff containing imprints of Trias-Jura plants.
- (4) Interbedded alkaline trachyte with shales containing fossil plants of Mesozoic age, 5 miles north of Esk.

With respect to (1) the author has carefully examined many similar conglomerate beds, and most of those mentioned by Wearne, and there is no doubt about the presence of trachytic, rhyolitic and basic-porphry waterworn pebbles in these beds which are apparently of Walloon age. The pebbles, however, are not quite comparable with the trachytes and rhyolites which have been described as volcanic lavas &c., but they are indistinguishable from the rhyolitic and trachytic material which occurs as intrusive dykes through the Palæozoic rocks of this area. These dykes are particularly well seen in the Taylor Range area, and have been described by Bryan.<sup>21</sup> There is no doubt that these dyke rocks, which represent the hypabyssal phase following the deep-seated intrusions of grano-diorite material occurring along the D'Aguilar Range, are older than the Trias-Jura sediments, as one never finds the intru-

<sup>20</sup> Proc. Roy. Soc., N.S.W., xlv.; A.A.A.S., xiv., Melbourne, 1913.

<sup>21</sup> Proc. Roy. Soc., Q'land, xxvi. (1914).

sions passing from the Palæozoic schists to the Mesozoic sediments, but on the other hand they stop at the junction.

One can thus easily account for the presence of these pebbles, and it is clear that there need be no relationship at all between these waterworn pebbles and the volcanic rocks which are found resting on the Walloon sediments, and in fact the evidence is against it. The author knows of no basalt pebbles, although melanocratic porphyritic rocks which have some resemblance to porphyritic basalt are sometimes met with, but these also occur as pre-Trias-Jura hypabyssal material.

(2) The piece of "volcanic tuff" containing fossil plant-remains such as *Teniopteris daintreei* was about 3 or 4 cubic feet in volume, and was found by Messrs. Wearne and Zerner. They also found another smaller piece. The author investigated this locality with Mr. Zerner, and although the same track was traversed to the top of the range, and diligent search made, no further traces of "volcanic tuff" were found, but on the other hand many small boulders of sandstone and quartzite were met with. This particular range is made up of quartzites, sandstones, conglomerates and shales, to a height of 1,500 feet above sea-level, and it is capped by about 600 feet of olivine basalt. Messrs. Wearne and Zerner found their plant-bearing fragments at heights 1,350 feet and 1,700 feet respectively.

Between the heights of 1,150 feet and 1,750 feet nothing other than basalt is met, except the occasional sandstone and quartzite boulders lying on the surface. In many other areas one finds these xenoliths included in the basic flows, and it is most probable that these quartzite and sandstone boulders which are indistinguishable from the underlying quartzites and sandstones have been caught up by the basalt, also that the "volcanic tuff," which to the author seems a light-coloured shale, simply represents underlying Mesozoic sedimentary material caught up in the basalt and brought along with it. There is no development at all of trachytic rocks in this district, and this has been pointed out by Wearne in his report to the Melbourne meeting of the A.A.A.S. in 1913.

(3.) Near Esk, one finds in the coal measures a great amount of felspathic material in the shales and sandstones. This is derived from the weathered grano-diorite which occurs a few miles to the north-east, and an examination shows all stages of the material, from thoroughly broken-down particles right up to fresh grano-diorite pebbles which are abundantly distributed through the beds.

The felspathic particles in the shales are often quite large, and bear a very close resemblance to the other weathered felspars on the surface of the included pebbles. The assumption that this material is trachytic tuff does not seem at all justified, and the author interprets it merely as felspathic sandstone and shale which are made up of material largely derived from weathered grano-diorite. A micro-section of the so-called "trachyte-tuff" which contains fossil plants was shown to the author by Mr. Wearne and it is best described as a fine-grained argillaceous sediment through which are distributed abundant angular grains of quartz. There is nothing of the microscopic characters of a tuff associated with this rock, and it bears no resemblance to the undoubted tuffs which are found in other parts of the area.

(4.) This occurrence of trachytic material is between portions 155 and 157, parish of Esk, and is encountered on the roadside as one ascends the ridge towards Ottaba Station from Esk. Instead of being alkaline trachyte interbedded with shales, the author regards it as a dyke of trachy-andesite. This material is very much weathered, but a somewhat similar rock which has been analysed occurs at portion 51, parish of Esk, and the latter is one of the series of rocks which are regarded as belonging to an intermediate series between the normal alkaline and sub-alkaline series. The strike of the sedimentary rocks is  $320^{\circ}$  east of north, and of the dyke  $340^{\circ}$  east of north, and the material cuts across the beds, so that it is a dyke and not an interbedded flow. The strata are fairly highly tilted here, and are made up largely of felspathic sandstones and shales, containing abundant Mesozoic plant-remains. Quite close in the railway cutting, large dykes of augite-andesite have definitely intruded and baked the

Mesozoic sediments. These sedimentary rocks are tentatively regarded as belonging to the Walloon stage of the Trias-Jura, so that the evidence here is certainly not in favour of a contemporaneous age for the trachytic rocks and the Walloon stage of the Trias-Jura, as has been advocated.

This question of age has been discussed at some length and all the important pieces of evidence which have been adduced in favour of a Trias-Jura age have been discussed. The author is unable to accept the evidence for a Trias-Jura age, but is firmly of the opinion that these rocks have all been extruded during the Cainozoic era.

The direct evidence as well as the indirect evidence leads one to this conclusion, and the correlation with similar extrusive material of Cainozoic age in New South Wales and Victoria is strong confirmative evidence.

The volcanic activity which resulted in the widespread distribution of these volcanic rocks probably began in the Lower Cainozoic and continued until the Upper Cainozoic.

### (III.) RHYOLITIC ROCKS.

These occur as lava flows, plugs, dykes and pyroclastic accumulations. They were all formed during the second great period of activity, and although they are represented in nearly all parts of the field where volcanic rocks are encountered, the greatest development is in the southern portion.

Wearne and Woolnough<sup>22</sup> made reference to the rhyolites of Mount Barney, Mount Maroon, Mount Alford and Glennie's Pulpit. Jensen<sup>23</sup> also referred to these rhyolites, but hitherto there has been no treatment of the big development of the rhyolitic rocks in the southern and south-eastern portions of the area.

These rocks have resulted from central eruptions for the most part, and setting aside the pyroclastic material they usually occur more or less as isolated masses along

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<sup>22</sup> Op. cit.

<sup>23</sup> Proc. Linn. Soc., N.S.W., xxxiv., p. 72.

somewhat definite lines. In the Springbrook and Tamborine areas however, fissure eruptions were most probably responsible for the extensive development of lithoidal rhyolite which is found there. All stages from holocrystalline to thoroughly glassy rocks are represented, and there is a great diversity of types. In the lava flows both the porphyritic and lithoidal varieties occur, though the latter are the more abundant.

Definite flows are found building up portions of Tamborine Plateau, Springbrook Plateau and MacPherson's Range from Mount Cougal on the east nearly to Mount Wilson on the west. Along the Coomera River there are also extensive lava flows. A general idea of the thickness of these flows has already been given.

Large masses which seem to represent plugs associated with central vents occur at Mount Lindsay, Mount Barney, Mount Maroon, the Maroon Range, Knapp's Peak, Mount Moon, Mount Alford, in the Esk district, particularly at Glen Rock, and in the Glass House Mountains district. Dykes are not frequently met with, but in the Cunningham's Gap area there are several. In Johnston's Creek below Mount Matheson there is a rhyolitic dyke striking in a north-west and south-east direction; its width cannot be determined as it passes under alluvium on the east side, but it is at least 50 feet wide and its western margin is a dark pitchstone. This pitchstone margin is several feet in thickness, and is somewhat porphyritic. Near Mount Alford, both pitchstone and rhyolitic dykes occur, and just near the Moogerah School an excellent pitchstone dyke is seen.

On the Upper Logan River between Mounts Lindsay and Barney, there are rhyolitic dykes intruding the Walloon sandstones and shales, and at the Yellow Pinch reserve, just to the east of Mount Barney, there is a rhyolitic dyke about 15 feet wide, which has severely baked the intruded sandstones and shales.

Heat metamorphism of the intruded coal-measures seems to have been more pronounced in connection with the Mount Barney mass than in any other locality examined.

Microscopical and chemical considerations show that there are two well-defined series of acid volcanics, namely the alkaline and sub-alkaline, but in addition there are representatives of a series intermediate between these two.

### *Sub-alkaline Acid Rocks.*

Among the sub-alkaline rhyolites we find both porphyritic and non-porphyritic varieties. The porphyritic rhyolites may be white, yellowish, or reddish in colour, and have phenocrysts of quartz and felspar. The phenocrysts of quartz are always transparent, and in the case of felspars which may be orthoclase, sanidine, or anorthoclase, they are typically colourless and glassy and not white. The relative proportions of phenocrysts and groundmass do not vary very much, and the phenocrysts always play a very subordinate part.

The groundmass varies from holocrystalline to holohyaline, as in the case of the pitchstones, and all intervening stages are represented in the various types.

The lithoidal varieties have a characteristic colour ranging from light grey to lavender. Occasionally one may see in the hand-specimen short, stout, lath-shaped crystals of orthoclase. Fluxion structure is very pronounced and is particularly evident on the weathered surface.

As described by Harker,<sup>24</sup> the banding of the rhyolites is seen on microscopic examination to be the result of slight differences in the nature and texture of the groundmass. While spherulitic structure on a microscopic scale is generally present in the rhyolites from this field, in one place only has it been found sufficiently coarse to be easily seen in the hand-specimen. This occurrence is on the banks of the Coomera River west of the Gin's Leap, and there one finds coarsely spherulitic rhyolite with spherulites averaging perhaps half an inch in diameter but ranging up to  $1\frac{1}{2}$  inches. The rock is very much altered and chalcedony occurs abundantly between the spherulites.

The microscopic characters may be summarised thus:—

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<sup>24</sup> Tertiary Igneous Rocks of Skye.

*Texture.*—The crystallinity varies from holocrystalline to hypocrySTALLINE, the grain-size is always very fine, less than .01 mm., and there is a great variety of fabrics. The fabric may be consertal as in the Chinghee Creek and Glennie's Pulpit rocks (*see* Plate XIII., fig 1), or micrographic as in the Mount Barney rock, but it is generally microspherulitic and often shows an axiolitic nature. In the porphyritic varieties, a strong fluxional arrangement of the groundmass may be noticed, while in the lithoidal varieties there is usually a strong development of banding shown.

The porphyritic crystals vary in size up to 4 mm. in diameter, but they have an average diameter of 2 mm. In many cases they are rounded and embayed.

*Minerals Present.*—The phenocrysts are usually quartz, and orthoclase or sanidine, though anorthoclase is present in some rocks. It frequently happens in those rhyolites with a hypohyaline groundmass that the quartz phenocrysts have curved cracks and the cleavage traces in the felspar are stained by a film of iron oxide. There is a marked absence of ferro-magnesian minerals, though in some cases greenish granules which may represent altered ferro-magnesian minerals occur. The groundmass invariably consists of quartz and orthoclase, and in some cases the quartz seems to be of a secondary nature. Apatite, zircon and magnetite are seen occasionally, particularly in the Mount Barney rock.

*Specimen 98.*<sup>25</sup>—Locality: Portion 58v, parish of Telemon, Upper Chinghee Creek. The rock occurs as a flow, yellowish white to grey in colour, and somewhat decomposed. It is porphyritic, being perpatie, and has phenocrysts of quartz, sanidine and anorthoclase averaging 2 mm. in diameter set in a very fine consertal groundmass of quartz and orthoclase. Ferro-magnesian minerals are absent although small greenish-brown granules throughout the slide may be altered augite. The specific gravity is 2.37. Name: *Rhyolite*.

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<sup>25</sup> These numbers refer to the micro-slide numbers in the University of Queensland collection.

This rock is very similar to the rhyolite at Glennie's Pulpit, Mount Alford.

*Specimen 54c.*—Locality: South-east of Tamborine Plateau. This specimen is greyish white in colour, and is seen to be hypocrystalline. It consists of small grains of quartz and felspar set in a micro-spherulitic groundmass of quartz and orthoclase. (See Plate XII., fig. 6.) Fluxion structure is common and thin veins of secondary quartz are numerous. Name: *Rhyolite*.

*Specimen 134.*—Locality: Glass Cutting, 4 miles north of Springbrook. This is a pale lavender in colour, and is lithoidal in character. In the hand-specimen it shows magnificent banding. The rock is cryptocrystalline, and apart from a very characteristic micro-spherulitic structure little else is seen. The slight variations in texture of the different bands through the rock, together with different degrees of pale staining, account for the rather pronounced banding which this rock shows. The fluxion structure shown by the rock mass is very fine, and at its base is developed an excellent perlite. This rock is characteristic of all the rhyolite lava on the Springbrook Plateau. Specific gravity 2.38. Name: *Lithoidal Rhyolite*.

*Specimen 223.*—This rock was obtained from the base of the upper dome of Mount Lindsay, at an elevation of 3,600 feet. The dome is made up of pitchstone and rhyolite agglomerate, and has a very rough columnar structure. The specimen described occurred as a large boulder in the agglomerate. In colour it is a deep brownish black passing into red in patches. It has a dull lustre and a conchoidal fracture, while the phenocrysts of quartz and felspar are particularly glassy. Under the microscope the groundmass is seen to be cryptocrystalline, and to have a very definite fluxion structure. Micro-spherulitic structure is well developed. The phenocrysts are quartz, sanidine and possibly anorthoclase. It is dopatic and phenocrysts which are frequently corroded and embayed are traversed by curved cracks. The perlitic cracks in many cases run right through the phenocryst and into the groundmass. These cracks are stained with limonite. (See Plate XII., fig. 4.)

This rock represents an intermediate stage between the

black pitchstone, with which it is associated, and the more crystalline rhyolite which has been poured out from the vent which has been plugged up by this material. All through the south-eastern area of acid pyroclastic material this rock is found, and is, together with the black pitchstone, the most constant inclusion. Name: *Rhyolite*.

*Specimen 229*.—Locality: 78v, parish of Palen, Tyler-ville. This material represents lava which has been poured out from Mount Lindsay. It is a light grey in colour, is perpatite, and has phenocrysts of quartz and sanidine set in a hypohyaline groundmass which contains quartz and orthoclase. Micro-spherulitic structure is common, and an axiolitic arrangement is frequent. Name: *Rhyolite*.

*Specimen 220*.—Locality: Mount Barney. This forms the main plug of Mount Barney and it is somewhat different from the other rhyolites, as it is much coarser. It is greyish white in colour and in patches is stained brown by the limonite resulting from the altered magnetite in the rock. This rock contains phenocrysts of felspar, a good deal of which is possibly anorthoclase, and quartz, the felspar being the more abundant. In many cases the felspars are subidiomorphic, whereas the quartz is allotriomorphic. The groundmass consists of a micrographic intergrowth of quartz and orthoclase, which is developed to a great perfection. (*See Plate XII., fig. 5.*) The intergrowth forms a framework around the phenocryst which in some cases has been embayed. Frequently one sees the intergrowth radiating off from a particular point or line and there is apparently no nucleus of felspar or quartz. Distributed through the rock are abundant small granules of magnetite which are frequently being altered into limonite. Minute grains of apatite and zircon occur as inclusions in the phenocrysts. Specific gravity 2.50. Name: *Micrographic Rhyolite*.

*Specimen 102*.—This light-grey rock occurs as a dyke through the Walloon measures on Johnston's Creek near Cunningham's Gap, portion 62v, parish of Clumber. It has a fine development of black pitchstone, containing porphyritic felspars, on its margin. The rock is holocrystalline and porphyritic. The rock is perpatite, and

phenocrysts consist of quartz, sanidine and an acid plagioclase somewhat sparingly developed; these are set in a very fine consertal groundmass. Micrographic intergrowths of quartz and orthoclase are very common. This rock is very similar to the rhyolite of Glennie's Pulpit at Mount Alford, which is a few miles to the south. Name: *Quartz Porphyry*.

### *Glassy Varieties.*

*Perlite*.—This is of rather limited occurrence and is found at the Glass Cutting on the Springbrook Plateau, between portions 117 and 121, parish of Numinbah. It is found at the base of the rhyolite flow, and is many feet thick. It can be seen grading off into the rhyolite and it exhibits beautiful fluxion structure and perlitic cracks. (See Plate XII., fig. 2.) Perlites are abundantly developed and the rock in many places is seen to be composed entirely of them. In colour it is a bluish grey when fresh, but it becomes brown on alteration. The rock has a specific gravity of 2.33.

Under the microscope, the holohyaline nature of the rock is very evident and the perlitic cracks are abundant. Trichites, cumulites and margarites are present in great abundance, and the cumulites are seen arranged in bands. It is noticeable that the trichites and margarites are arranged along parallel lines, and these intersect the bands of cumulites at an angle of  $40^{\circ}$ .

*Pitchstones*.—These occur as dykes and as inclusions in the acid pyroclastic material in the southern portion of the area. The dyke occurrences are near Cunningham's Gap. Near the Moogerah School at the foot of Mount Alford, there is a green pitchstone dyke through the Walloon measures. There are very occasional phenocrysts of sanidine up to 1.5 mm. long, but apart from this the rock is a glass in which are occasional lath-shaped feldspars .05 mm. in length. Trichites are common and spherulites are very abundant and they tend to have an axiolitic arrangement, parallel to the fluxion bands. (See Plate XII., fig. 3.) A number of micro-slides of this rock were prepared for class purposes, and in one section, a phenocryst of micrographic intergrowth of quartz and orthoclase

round a kernel of sanidine is seen. The phenocryst is 2 mm. long, and the dyke is no doubt associated with the "granophyre" which Dr. Woolnough<sup>26</sup> has described from the northern base of Mount Alford.

The most characteristic pitchstone, however, is the one which occurs over the whole of the southern area, as inclusions in the acid pyroclastic material. It is remarkably uniform in nature and occurs in boulders of all sizes. It is found in great abundance at Mount Lindsay and forms the major portion of the agglomerate which makes up the top dome of Mount Lindsay. The pitchstone itself occurs in tremendous blocks many tons in weight, and when fresh has a beautiful glassy black appearance. It has a conchoidal fracture, and the white felspar phenocrysts which occur abundantly through it show up well. In thin sections it is seen to be made up of a light-brown glass and it has phenocrysts of sanidine, anorthoclase, quartz and occasionally augite. These phenocrysts are usually corroded and embayed and often the glass is seen entering along the cleavage cracks. (*See* Plate XII., fig. 1.) The glassy groundmass shows perfect fluxion structure and it is traversed by perlitic cracks. In several places through the sections small angular fragments of felspar may be seen, and these have apparently resulted from the disruption of the phenocrysts while the groundmass was still in a mobile state. Around these fragments the fluxion structure is particularly pronounced, and their sharp angles are in great contrast to the rounded corners of the larger phenocrysts which have remained intact. The specific gravity is 2.39.

Cracks occur abundantly in the phenocrysts and are of interest as they are seen to have the same characters as those described in a perlitic pitchstone from the Tweed River by Smeeth.<sup>27</sup>

The cracks are much more abundant in the quartz than in the felspar, and in some cases they pass continuously from the matrix into the quartz crystals and also into the felspar crystals. One does not, however, see the

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<sup>26</sup> Proc. Roy. Soc., N.S.W., xlv., p. 150.

<sup>27</sup> Proc. Roy. Soc., N.S.W., for 1894 (xxvii.).

completion of the matrix perlite in the quartz, nor perlitites formed in the quartz and completed in the matrix as described by Watts.<sup>28</sup> Sometimes, however, perlitic cracks surround the crystals.

In the hand-specimen this pitchstone bears a very close resemblance to one described by Harker<sup>29</sup> from Glas Bheinn Mhor in Skye, and it is a matter of difficulty to distinguish between them.

When the analysis is recalculated to 100 per cent. after removing the water and is compared with the recalculated analysis of the Mount Barney rhyolite a very close resemblance is seen, so that they in all probability have a common source. (*See* Table VII.) This is of interest as the rocks are so different in texture and in addition are separated by several miles.

*Rhyolites intermediate between the sub-alkaline and alkaline varieties.*

*Specimen 233.*—Locality: Portion 28v, parish of Biarra. This light-grey rock forms a hill on the west side of the railway line, just near the Ottaba railway station. It is a lithoidal variety, but has occasional phenocrysts of anorthoclase set in a hypohyaline groundmass which contains very fine equigranular quartz and orthoclase. Good fluxional arrangement is shown through the rock in places, and the weathered surface often shows a ropelike structure owing to the twisting of the viscous magma when extruded. Through the rock, one sees under the microscope indefinite green granules which are difficult to determine. This rock is much richer in soda than potash. The specific gravity is 2.61. Name: *Rhyolite*.

*Specimen 234.*—Locality: Glen Rock, Esk. This is a light brown in colour, and it forms the large mass of Glen Rock. It is remarkably free from phenocrysts although occasionally one sees crystals of sanidine which are slightly larger than the rest of the mass. The rock is hypohyaline, and the grain-size is very fine being about .075 mm. The fabric shows a very poor fluxional arrangement, and there is a tendency for the felspar laths to

<sup>28</sup> Q.J.G.S., 1. (1894).

<sup>29</sup> Skye Memoir, p. 408.

group themselves into stellate masses. (*See Plate XIII., fig. 2.*) The minerals present are quartz, anorthoclase and sanidine. The zeolite, stilbite, occurs in cracks through the rock. The specific gravity is 2.61. Name: *Rhyolite*.

#### *Alkaline Rocks.*

These rocks have been fully described by Jensen,<sup>30</sup> and it is worthy of note that there is a very great difference both macroscopically and microscopically between these rocks and the rhyolites already described in this paper.

We may group these rocks under two headings:

- (a) Pantellerites;
- (b) Comendites.

*Pantellerites*.—One finds these in the Glass House Mountains district, at Mount Ngun-Ngun and the Trachyte Range, and also in the neighbourhood of Mount Flinders. They are usually greyish to bluish-green in colour and often show in the hand-specimen dendritic and mossy aggregates of ægirine. The fabric may be trachytic, hyalopilitic, pilotaxitic or orthophyric, and the minerals are quartz, sanidine, anorthoclase, riebeckite, arfvedsonite as well as rarer minerals.

*Comendites*.—These are usually lighter in colour than the above, and occur at Mounts Conowrin, Tibrogargan, Beerburum and Ewin in the Glass House Mountains area, and also at Mount French. Jensen<sup>31</sup> records them from Spicer's Peak and Mount Mitchell, but the author has failed to find them there. The fabric is microgranitic or orthophyric, and the minerals, quartz, sanidine, soda-sanidine, ægirine, riebeckite and arfvedsonite.

These special alkaline types are very limited in their occurrence and their total volume is insignificant when compared with that of the more normal rhyolites in the southern portion.

#### *Chemical Composition of Rhyolitic Rocks.*

(a) *Sub-alkaline and intermediate types*.—An examination of the analyses shows that there is a close

<sup>30</sup> Proc. Linn. Soc., N.S.W., 1906-1909.

<sup>31</sup> A.A.A.S., xii., Brisbane, 1909, p. 253.

similarity amongst these rocks, and that they are all of a decidedly acid nature. The alumina value is a little lower and the total iron-oxides value a little higher than is usual in these rocks.

This deficiency in alumina and richness in iron-oxides is a characteristic of the rocks of the area as a whole, but is much more pronounced in the basic representatives. The lime value is normal, and is to be contrasted with the much lower percentages in the alkaline types. The alkali contents are a little above normal, and it is noticeable that in the two rocks from the Esk district the soda is in excess of the potash. These two rocks seem to be midway between the sub-alkaline and alkaline types.

Two analyses have been inserted in the table for comparison, and a somewhat close relationship exists between the Chinghee Creek rhyolite and the perlite from Yellowstone National Park; while between the Springbrook rhyolite and a biotite-rhyolite from Sugarloaf Hill, San Francisco, especially close chemical relationship exists.

The exact locality of the pitchstone in Column IV. from MacPherson's Range is unknown, but Mr. G. W. Card of the Mining Museum, Sydney, kindly sent me the analysis, and it is evident that it is very similar to the Mount Lindsay pitchstone, and in fact it may be from the same locality.

The analysis of the perlitic pitchstone from Tweed River is not a complete one, but it is richer in alumina and poorer in alkalis than the other rocks. This analysis, which was originally published by Smeeth,<sup>32</sup> and which is undoubtedly an analysis of the perlitic pitchstone from Tweed River, has been published in a subsequent paper by E. C. Andrews<sup>33</sup> as the analysis of the Mount Lindsay rock, but there is obviously a mistake in locality. The analysis in Column IV., with which Mr. Card of the Mining Museum, Sydney, kindly furnished me, seems rather to be an analysis of the Mount Lindsay rock.

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<sup>32</sup> Op. cit., p. 311.

<sup>33</sup> Rec. Geol. Surv., N.S.W., vol. vii., p. 240.



## Norm.

| Quartz          | 37-38 | 32-94 | 32-9 | 32-94 | 32-7 | 33-06 | 28-56 | 29-70 | 20-64 | 27-36 |
|-----------------|-------|-------|------|-------|------|-------|-------|-------|-------|-------|
| Orthoclase      | 28-36 | 28-91 | 32-2 | 28-91 | 30-0 | 29-47 | 28-91 | 28-36 | 21-68 | 16-68 |
| Albite ..       | 23-06 | 27-77 | 24-6 | 27-77 | 25-1 | 27-77 | 34-06 | 35-63 | 41-92 | 40-87 |
| Anorthite ..    | 4-45  | 0-83  | 4-7  | 0-83  | 2-8  | 3-61  | 3-06  | 2-78  | 3-89  | 4-45  |
| Corundum        | ..    | ..    | ..   | ..    | 1-4  | ..    | ..    | ..    | ..    | ..    |
| Diopside ..     | 0-22  | 2-10  | 0-8  | 2-10  | ..   | 0-86  | ..    | ..    | ..    | 3-81  |
| Hypersthene     | 1-00  | ..    | 1-5  | ..    | 1-3  | 1-20  | 2-02  | 0-56  | 3-11  | 4-34  |
| Wollastonite .. | ..    | 0-35  | ..   | 0-35  | ..   | ..    | ..    | ..    | ..    | ..    |
| Magnetite ..    | 1-16  | 3-71  | 0-5  | 3-71  | 1-9  | 2-09  | 1-86  | 0-70  | 0-93  | 0-46  |
| Hæmatite ..     | 1-12  | ..    | ..   | ..    | ..   | 0-64  | ..    | ..    | ..    | ..    |
| Ilmenite        | 0-46  | ..    | ..   | ..    | ..   | 0-46  | 0-76  | ..    | ..    | 1-37  |
| Apatite ..      | 0-31  | 0-34  | ..   | 0-34  | ..   | 0-34  | 0-34  | ..    | 0-34  | 0-34  |

I.—Rhyolite, I. 3.2.3. Tehanose, Chinghee Ck., por. 58v,  
parish Telukon.<sup>1</sup>

II.—Rhyolite-Perlite, I. 4.2.3. Toseanose, Midway Geyser  
Basin, Yellowstone Park.\*

III.—Pitchstone, I. 4(3).1.3. Liparose, Mt. Lindsey.<sup>2</sup>

IV.—Pitchstone, I. 4(3).1.3. Liparose, MacPherson's Range.†

V.—Rhyolite, I. 4.1.3. Liparose, Mt. Burney.<sup>2</sup>

VI.—Rhyolite, I. 4(3).1.3. Liparose, Springbrook Plateau,  
por. 80, parish Numbah.<sup>2</sup>

VII.—Biotite-Rhyolite, I. 4.1.3. Liparose, Sugarloaf Hill,  
San Francisco.‡

VIII.—Rhyolite, I. 4.1.4. Kallerudose, Glen Rock, Esk.<sup>2</sup>

IX.—Rhyolite, I. 4.2(1).4. Læscenose, Ottaba, por. 28v,  
parish Biarro, Esk District.<sup>2</sup>

X.—Perlitic-Obisidian, Tweed River, New South Wales.§

\* Idings, Igneous Rocks, vol. II, p. 127.

† From Mr. G. W. Card, Mining Museum, Sydney; Analyst, Mr. M'ngaye.

‡ U.S.G.S. Prof. Paper 76, p. 104

§ W. F. Smeeth, Roy. Soc. N.S.W. for 1894, vol. xxvii.

<sup>1</sup> Ann. Rept. Agric. Chem., Q'land., for 1913. Slight altera-  
tions have been made subsequent to publication by Agric.  
Chem.

<sup>2</sup> Ann. Rept. Agric. Chem., Q'land., for 1914.

TABLE II.—ALKALINE RHYOLITES.

|                                      | I.     | II.                 | III.   | IV.    |
|--------------------------------------|--------|---------------------|--------|--------|
| SiO <sub>2</sub> .. ..               | 74.20  | 72.38               | 71.56  | 74.88  |
| Al <sub>2</sub> O <sub>3</sub> .. .. | 11.75  | 12.21               | 11.94  | 11.34  |
| Fe <sub>2</sub> O <sub>3</sub> .. .. | 1.92   | 3.36                | 4.68   | 2.80   |
| FeO .. ..                            | 1.30   | 0.69                | 0.46   | 0.95   |
| MgO .. ..                            | 0.30   | 0.17                | 0.32   | 0.35   |
| CaO .. ..                            | 0.19   | 0.18                | 0.28   | 0.21   |
| Na <sub>2</sub> O .. ..              | 4.25   | 3.52                | 4.88   | 4.20   |
| K <sub>2</sub> O .. ..               | 5.00   | 5.20                | 5.03   | 4.98   |
| H <sub>2</sub> O+ .. ..              | 0.27   | 0.86                | 0.40   | ..     |
| H <sub>2</sub> O- .. ..              | 0.06   | 0.69                | 0.33   | ..     |
| CO <sub>2</sub> .. ..                | 0.01   | ..                  | ..     | ..     |
| TiO <sub>2</sub> .. ..               | 0.13   | 0.25                | 0.17   | 0.19   |
| P <sub>2</sub> O <sub>5</sub> .. ..  | abs.   | tr.                 | tr.    | 0.02   |
| MnO .. ..                            | 0.20   | 0.70                | tr.    | 0.08   |
| NiO .. ..                            | 0.03   | 0.04                | 0.01   | ..     |
| ZrO <sub>2</sub> .. ..               | 0.38   | ..                  | ..     | ..     |
| F .. ..                              | 0.02   | ..                  | ..     | ..     |
| Cl .. ..                             | 0.17   | 0.01                | ..     | ..     |
| Total ..                             | 100.12 | 100.26              | 100.06 | 100.00 |
| Spec. Grav. ..                       | 2.62   | 2.47<br>(vesicular) | 2.71   | ..     |
| <i>Norm.</i>                         |        |                     |        |        |
| Quartz .. ..                         | 34.74  | 31.68               | 25.08  | ..     |
| Orthoclase .. ..                     | 29.47  | 30.58               | 29.47  | ..     |
| Albite .. ..                         | 25.15  | 29.34               | 33.54  | ..     |
| Anorthite .. ..                      | ..     | 1.11                | ..     | ..     |
| Sodalite .. ..                       | 4.85   | ..                  | ..     | ..     |
| Diopside .. ..                       | 0.68   | ..                  | 1.08   | ..     |
| Corundum .. ..                       | ..     | 0.51                | ..     | ..     |
| Hypersthene .. ..                    | 0.99   | 1.72                | 0.30   | ..     |
| Acmite .. ..                         | 0.46   | ..                  | 6.93   | ..     |
| Magnetite .. ..                      | 2.55   | 1.39                | 0.93   | ..     |
| Hæmatite .. ..                       | ..     | 3.21                | 1.60   | ..     |
| Ilmenite .. ..                       | 0.15   | 0.61                | 0.46   | ..     |
| Fluorspar .. ..                      | 0.08   | ..                  | ..     | ..     |
| Zircon .. ..                         | 0.37   | ..                  | ..     | ..     |
| Pyrite .. ..                         | 0.18   | ..                  | ..     | ..     |
| &c. .. ..                            | .33    | ..                  | .73    | ..     |

I.—Comendite, I. 3.1.3. Alaskose, Mt. Conowrin, Glass House Mountains.<sup>1</sup>II.—Pantellerite, I. 4.1.3. Liparose, Mt. Ngungun, Glass House Mountains.<sup>1</sup>III.—Pantellerite, I. 4.1.3. Liparose, Trachyte Range, Glass House Mountains.<sup>1</sup>IV.—Average analysis of six Comendites.<sup>2</sup><sup>1</sup> Jensen, Proc. Linn. Soc. N.S.W., xxxi. (for 1906).<sup>2</sup> Daly, Igneous Rocks, p. 20.

The rhyolite from Ottaba, which is relatively low in alkali contents, has an excess of soda over potash, also the lime content is considerably higher than in any of the other rhyolitic rocks.

(b) *Alkaline Rhyolites*.—These are all very acid rocks, and they differ from the sub-alkaline types in having a slightly lower alumina, higher total iron-oxides, much lower lime, and much higher total alkalis. The rocks are all sodipotassic with potash in excess of the soda. It is also noticed that normative acmite exists in two of the rocks.

The average of 6 comendites given in Column IV. agrees remarkably well with the Mount Conowrin rock.

#### *Acid Pyroclastic Rocks.*

These occur as breccias, agglomerates and tuffs, and as previously indicated have an extensive development in the southern portion of the area. Quite apart from the main development which is probably of Middle Cainozoic age, there are the Brisbane tuffs. These were first determined as made up of volcanic ash by W. H. Rands<sup>34</sup> in 1887. He gave a good account of their occurrence and also showed them to be at the base of the Ipswich formation, so that they are of early Trias-Jura age. The Brisbane tuff is really a rhyolite-tuff and it consists of very fine-grained feldspathic matrix with blebs of quartz, orthoclase and plagioclase. It has been very much silicified in most places, and it has undergone a great deal of alteration.

Under crossed nicols the base seems to be made up of very fine-grained particles of feldspar and quartz, but in ordinary light the original shapes of the particles which were originally glass but are now quite altered and crystallised are seen, and show the characteristic drawn-out shapes with frequent concave faces. Inclusions are numerous, and one finds fragments of the underlying schist and also carbonised wood. In certain places, but particularly on the northern side of the Brisbane River,

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<sup>34</sup> Q'land Geol. Surv., Pub. 34, 1887.

there is a hardened band up to 2 feet thick right at the base of the tuff. This band is more compact than the overlying material and in many respects it suggests a rhyolite flow. It is noticeable, however, that this band is best developed where the overlying tuff is most silicified, and it is highly probable that it represents a layer of tuff at the bottom which has received an extra amount of silicification owing to the percolating solutions being held up by the impervious underlying shale band.

The greatest development of acid pyroclastic material occurs along MacPherson's Range and the ridges running off it in a northerly direction. It is distributed over an area of about 300 square miles, and was in all probability almost continuous. In general appearance, it is remarkably uniform as far as the matrix is concerned, but there is considerable variation in the size and abundance of the included fragments.

Occurrences of tuff are only occasional and the most typical development showing definite bedded structure was met with on the northern banks of the Coomera River, a few miles west of the Gin's Leap. The tuff has in places been much silicified and made very compact, although it is usually in a rather loose state of aggregation. The matrix is usually very fine-grained and a dirty yellow in colour, though it may be white or a bright green in patches. The greenish colour seems to be due to the presence of chloritic material.

The included fragments consist for the most part of rhyolite, but near the base there are large rounded boulders of basalt very similar to the underlying basaltic flows. The rhyolite inclusions range from holocrystalline and porphyritic varieties to pitchstones, and a black glassy pitchstone is a very widespread and characteristic inclusion. These inclusions often show a definite brecciated or welded structure.

On portion 136, parish of Telemon, at Mr. P. Burnett's selection on Chinghee Creek, a silicified tree trunk about 12 inches in diameter and 4 feet long was found included in the agglomerate. Thin veins of silicified ash material were seen along what had apparently been cracks in the

log. As described earlier. at Upper Christmas Creek, a large included mass of coal-bearing shale was found included in the agglomerate. The cliffs of compact pyroclastic material which occur frequently on the valley sides all through the southern area are very characteristic, and when examined are seen to have an imperfect columnar structure and to be weathered out into caves. These caves are often several feet in diameter, and on the weathered surface, the angular and subangular included fragments of rhyolite &c., generally a few inches in diameter, stand out as a result of their superior weathering properties.

#### (IV.) TRACHYTIC ROCKS.

These are found occurring in much the same way as the rhyolitic rocks, but they have a much more limited occurrence. The most extensive development is along the Main Range from Wilson's Peak to near Mount Castle, and they seem to have resulted from a fissure eruption. Along a line from Mount Greville to Redbank Plains they occur at Mount Greville, Mount Edwards, Mount French, Mount Flinders, and at Redbank Plains. Isolated peaks occur in the Esk and Glass House Mountains districts, and there are also areas of trachytic rocks at Woodhill and Cainbale Creek. All these occurrences have probably resulted from central eruptions.

The trachytic rocks have been dealt with at length by Dr. Jensen in several papers, but he has given them a more widespread distribution than they really have. He states<sup>35</sup> that he has "good reason to believe that the whole of the Little Liverpool Range from Wilson's Peak to the Rosewood District is mainly trachytic"; also, that "the culminating peaks of the range like Spicer's Peak, Mount Mitchell, Mount Cordeaux, Mount Huntley, Mount Roberts, &c., are apparently of trachytic composition." Jensen also states<sup>36</sup> that "At Spring Bluff, between Helidon and Toowoomba, trachytes underlie basalts, but not having examined sections, I cannot say whether they are very alkaline or not."

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<sup>35</sup> Jensen, Proc. Linn. Soc., N.S.W., xxxiv., p. 73.

<sup>36</sup> Jensen, Proc. Linn. Soc., N.S.W., xxxiii., p. 576.

As Wearne<sup>37</sup> has pointed out, Jensen has called the southern portion of the Main Range the Little Liverpool Range. However, while trachytic rocks are found along the Main Range as far north as Mount Castle, they do not extend from there on to the Rosewood district, also the top of the Main Range and the culminating peaks such as Mount Roberts, Mount Huntley, Spicer's Peak, Mount Mitchell, Mount Cordeaux and Mount Castle, consist of basaltic rocks, for the most part olivine-basalt.

At Spring Bluff, there seems to be no evidence of trachytic rocks at all, but on the other hand, the basalt is found resting on the Walloon shales and sandstones. The map and sketch-section on page 74 of Jensen's paper on the Geology of Mount Flinders and Fassifern Districts are rather misleading in showing the extent of the trachytic rocks on the Main Range, and also of the rhyolitic rocks in the south-west portion of the area. The sketch-section also seems to the author incorrect, in showing Cretaceous rocks underlying the basalt of the Darling Downs. There is no record of such being the case, but on the other hand, where the basalt flows have been worn down by the streams to the underlying rocks, these are seen to be, in all cases, the so-called Trias-Jura sediments. Also in the section through Mount Tamborine no indication is given of the rhyolitic rocks which occur on the eastern side.

The trachytic rocks in the Fassifern and Mount Flinders districts have been dealt with by Jensen in several papers, and also by Wearne and Woolnough, but hitherto the Esk, Woodhill and Cainbale Creek material has not been really described.

The Cainbale trachyte is apparently the base of a worn-down plug, and the Woodhill trachyte has apparently come up as a sill. The Esk trachytes occupy an intermediate position between the alkaline and sub-alkaline series; this is best illustrated by the variation diagrams. (*See* Plates VI.-VIII.) The Cainbale Creek trachyte is sub-alkaline, but the other trachytes are all of a definite alkaline nature.

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<sup>37</sup> Proc. Roy. Soc., N.S.W., xlv., p. 137.

These trachytes are represented by the leucocratic and melanocratic varieties, though the light-coloured varieties are the more abundant. The leucocratic varieties are light grey to bluish grey in colour, and range from holocrystalline to holohyaline; while the fabric may be trachytic, microgranitic, or orthophyric. There are little or no soda-lime-felspars, but one finds sanidine, soda-sanidine and anorthoclase. The matrix minerals are aegirine, riebeckite, arfvedsonite; olivine and biotite do not occur. The melanocratic varieties are dark grey or brown in colour, and are usually less porphyritic than the leucocratic types.

The texture varies from holocrystalline to holohyaline, and the fabric may be almost pilotaxitic, although generally it is trachytic. The felspars are orthoclase, anorthoclase, micropertthite and lime-soda-felspars. The matrix minerals are aegirine, augite, magnetite and ilmenite.

Glassy varieties of the trachytic rocks are not so abundant as those of the rhyolitic rocks, but at Mount Flinders there is a very fine trachytic glass which Jensen has described, also at Cainbale Creek there is a dull green trachytic pitchstone associated with the trachyte.

*Specimen 128.*—Locality: Cainbale Creek, portion 12, parish of Nindooimbah. This is a greyish rock in the hand-specimen. It is holocrystalline and slightly porphyritic. The phenocrysts, which are frequently anorthoclase, occur as sub-idiomorphic crystals up to 1.5 mm. in diameter. The groundmass is orthophyric and is made up of short stout prisms of sanidine and occasional crystals of pale augite. Abundant granules of magnetite occur all through the section. The rock has been considerably altered, and limonite and chlorite are abundant. The chlorite and some of the limonite are the result of alteration of the granules of pyroxene which are distributed through the rock; some of the limonite is also derived from the magnetite. Small patches of a secondary carbonate, probably calcite, occur through the rock. The specific gravity is 2.40, and this low value is no doubt due to the somewhat cavernous nature of the rock. Name: *Orthophyric Trachyte*.

*Specimen 129.*—This is from the same locality as the previous rock, and is a somewhat mottled greenish-grey

rock, with a dull lustre, but showing very evident signs of fluxion. It is made up almost entirely of glassy material, but it has occasional phenocrysts of sanidine, and possibly anorthoclase. These phenocrysts are rounded and they occur up to 1.5 mm. in diameter. The rock is obviously a more quickly cooled portion of the same material which produced the above rock, as one can see intermediate stages between the two. The groundmass shows strong fluxion structure and it is partly microfelsitic. The glassy portion of the rock is corroded with aggregates of microlites which take up a variety of shapes, many of them radiating, but feathery and allied forms are common. Microspherulitic structure occurs here and there. There are no perlitic cracks. Name: *Trachytic Pitchstone*.

*Specimen 131.*—Locality: Woodhill, portion 122, parish of Logan. This rock is in a very altered condition, and it is a matter of great difficulty to obtain a specimen fresh enough for sectioning. It is found, however, to be holocrystalline, and to be made up of sanidine, ? oligoclase and chlorite, magnetite and limonite being also abundant. The rock is really too altered to determine exactly, but it is in many respects similar to the Cainbale Creek trachyte, although the presence of the acid plagioclase is rather a variation from that. Name: *Trachyte*.

*Specimen 230.*—Locality: Portion 136A, parish of Esk. This rock occurs to the west of Esk, and has been referred to by E. O. Marks. He stated<sup>38</sup> that the trachyte on the summit of the ridge where it occurs is covered with sandstone, but such does not appear to be the case. The rock is very weathered, and much resembles a brown sandstone in appearance and also in the manner of weathering. It is a matter of great difficulty to obtain fresh samples, but in portion 136A there is a bluff of material which is weathered out into a cavernous structure and the freshest material obtainable was at the base of the bluff. Fluxion structure is shown very clearly in the massive rock.

This rock is very much like the brown Helidon sandstone in general appearance and it is slightly porphyritic. The porphyritic crystals are nearly all short, stout lath-

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<sup>38</sup> Q'land Govt. Min. Jour., xiii., July, 1912.

shaped, and show broad lamellar twinning as well as simple twinning; in addition to these, somewhat longer crystals of sanidine are seen. The phenocrysts vary from .75 to 1 mm. in length, and the groundmass is made up of an equigranular mass of felspar and secondary quartz, the granules of which are about .1 mm. in diameter.

The groundmass is somewhat difficult to determine, but it seems to be constituted of sanidine and albite, through which is distributed abundant quartz which seems to be almost entirely secondary. Limonite is very abundantly distributed all through the rock. The specific gravity is 2.49. Name: *Trachyte*.

*Specimen 51.*—Locality: Portion 51, parish of Esk. This is an altered rock and somewhat difficult to determine. Apart from the fact that it intrudes the Walloon coal-measures, one has little indication as to its actual age. In the hand-specimen this is a greenish-grey rock, fine-grained and containing occasional phenocrysts of a flesh-coloured felspar. Microscopically, it is seen to be holocrystalline and to be made up almost entirely of felspar. There are occasional stout idiomorphic plagioclase phenocrysts, 1.5 mm. in length, set in stout idiomorphic felspars with an average length of .75 mm., while all through the rock are allotriomorphic patches of quartz.

There are very occasional sub-idiomorphic crystals of augite .6 mm. in diameter which show twinning. All through the rock one finds patches of chlorite, and this has almost certainly been derived from altered augite granules. The plagioclase is very largely albite, as it has an extinction angle of  $15^\circ$  on the (010) face, and a refractive index lower than quartz. Andesine, with a composition  $Ab_3An_2$ , occurs frequently. Magnetite and ilmenite are abundant, and occasional crystals of apatite are seen.

Secondary minerals, such as calcite, chlorite and serpentine, occur also; possibly some of the quartz is secondary. This rock in many respects appears to be a more acid representative of the material which occurs in the same district as augite-andesite, and which is described later. The specific gravity is 2.69. Name: *Quartz-trachyte*.

*Trachytic Tuffs, Breccias &c.*

These are of limited development and the chief occurrences are on the Main Range near Spicer's Gap and Mount Matheson, also near Mount Flinders. The intense explosive action producing these accumulations seems to have taken place after the trachytic rocks had been extruded, and on the Main Range after the fissure had been almost plugged up so that one got eruptions of the central type. Jensen<sup>39</sup> has described this material and the author has no new developments to add.

There is a very characteristic breccia developed near Mount Matheson, and it may pass into a coarse agglomerate with trachyte boulders several tons in weight, or into trachytic tuff with a beautiful fragmentary glass as a base. The breccia has been considerably altered and chalcedony is abundant all through it; also a ferruginous cement is common.

The tuff is well developed just below the elbow on the Warwick coach road through Spicer's Gap. It is seen to be a typical tuff, and has a fragmental glass groundmass which shows the curious drawn-out fragments with concave surfaces. The groundmass has not undergone very much alteration and is much better preserved than in the Brisbane tuff. All through the rock are crystals of sanidine, anorthoclase and plagioclase, also abundant inclusions of rock-fragments. These rock-fragments are trachyte, andesite, basalt and shale.

At Ivory's Knob near Mount Flinders there is also a very good trachyte tuff.

*Chemical Composition of Trachytes.*

Most of these rocks are seen to be rather acid in nature, and they are either sodi-potassic or dosodic, with soda in

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<sup>39</sup> Proc. Linn. Soc., N.S.W., for 1909, vol. xxxiv.

excess of potash except in the case of the trachyte from the summit of Mount Flinders.

The Esk trachyte shows a very low value for alumina, but this rock is rather altered, and shows a very high ferric oxide value: this is no doubt due, to some extent, to the limonite present.

The Cainbale Creek trachyte is seen to differ considerably from the other rocks; it has a low alumina and high iron-oxides value, the magnesia is comparatively high, while the lime is much higher than in any of the others.

The soda trachyte from the Main Range is a melanocratic one, and it is seen to have a very high soda value. It is chiefly remarkable for the high titanium oxide, and Jensen has indicated that there is probably a mineral belonging to the lavenite group, which accounts largely for this.

The trachyte from portion 51, parish of Esk, is rather an altered one, and it is noticeable for the low alumina and the comparatively high magnesia and lime, also the soda preponderates over potash very much.

TABLE III.—TRACHYTES.

|                                | I.       | II.    | III.   | IV.   | V.       | VI.      | VII.     | VIII. |
|--------------------------------|----------|--------|--------|-------|----------|----------|----------|-------|
| SiO <sub>2</sub>               | 69.32    | 66.40  | 65.31  | 65.09 | 64.58    | 60.58    | 56.78    | 60.00 |
| Al <sub>2</sub> O <sub>3</sub> | 16.06    | 12.03  | 12.08  | 14.43 | 17.52    | 18.06    | 14.47    | 10.58 |
| Fe <sub>2</sub> O <sub>3</sub> | 1.42     | 8.23   | 5.12   | 3.21  | 2.56     | 3.05     | 2.80     | 6.18  |
| FeO                            | 0.88     | 0.64   | 3.07   | 0.13  | 0.96     | 1.38     | 6.05     | 4.72  |
| MgO                            | 0.06     | 0.40   | 0.96   | 0.10  | 0.22     | 0.23     | 0.34     | 1.97  |
| CaO                            | 0.31     | 0.62   | 2.50   | 1.18  | 0.39     | 1.74     | 2.47     | 2.88  |
| Na <sub>2</sub> O              | 6.01     | 5.26   | 4.91   | 7.26  | 6.41     | 5.01     | 8.67     | 6.58  |
| K <sub>2</sub> O               | 4.23     | 3.26   | 4.72   | 3.24  | 6.23     | 6.87     | 4.51     | 2.20  |
| H <sub>2</sub> O +             | } 1.09 } | ( 1.85 | 0.57 } | 2.42  | ( 0.30   | 0.90     | 1.70     | 1.65  |
| H <sub>2</sub> O -             |          | { 0.50 | 0.47 } |       | { 0.11   | 0.99     | 0.56     | 0.65  |
| CO <sub>2</sub>                | ..       | ..     | ..     | ..    | 0.08     | ..       | ..       | ..    |
| TiO <sub>2</sub>               | 0.62     | 0.82   | 0.49   | 2.50  | 0.13     | 0.83     | 2.00     | 1.56  |
| P <sub>2</sub> O <sub>5</sub>  | ..       | 0.23   | 0.14   | ..    | tr.      | ..       | ..       | 0.44  |
| MnO                            | ..       | 0.05   | 0.11   | ..    | 0.08     | 0.04     | tr.      | 0.18  |
|                                |          |        |        |       | &c. 0.40 | &c. 0.07 | &c. 0.05 |       |
| Total                          | 100.00   | 100.29 | 100.45 | 99.56 | 99.97    | 99.75    | 100.40   | 99.59 |
| Spec. Grav.                    | ..       | 2.49   | 2.40   | ..    | 2.62     | ..       | ..       | 2.69  |

## Norm.

|                      | 17-58<br>25-02 | 21-84<br>19-46 | 15-00<br>27-80 | 10-32<br>18-90 | 2-76<br>30-69 | 1-50<br>40-59 | ..<br>26-69 | 11-79<br>42-91 |
|----------------------|----------------|----------------|----------------|----------------|---------------|---------------|-------------|----------------|
| Quartz ..            | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Orthoclase ..        | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Albite ..            | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Anorthite ..         | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Nepheline ..         | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Corundum ..          | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Diopside ..          | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Hypersthene ..       | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Aenite ..            | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Olivine ..           | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Magnetite ..         | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Hornblende ..        | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Ilmenite ..          | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Apophite ..          | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Zircon ..            | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Titanite ..          | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Pyrite ..            | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |
| Soda-metasilicate .. | ..             | ..             | ..             | ..             | ..            | ..            | ..          | ..             |

I.—Porphyritic Soda-Trachyte, I. 4.1.4. Kallerudose, Mt. Flinders.<sup>1</sup>II.—Trachyte, I. 4.1.4. Kallerudose, por. 130a, parish Esk.<sup>2</sup>III.—Trachyte, II. 4.1.3. Gorrudose, Cambable Ck., por. 12, parish Nindoumbah.<sup>3</sup>IV.—Soda-Trachyte, I. 5.1.4. Nordmarkose, 2,000 ft. level, Coach road, Spacer's Gap, Main Range.<sup>1</sup>V.—Trachyte, I. 5.1.3(4). Phlegrose, Mt. Beerwal, (Hass House Mountains).<sup>2</sup>VI.—Trachyte, I. 5.2.3. Pultaskose, Summit, Mt. Flinders.<sup>1</sup>VII.—Phonolitic Ægirine Trachyte, II. 5.1.4. Umpfokos<sup>1</sup>, foot of Mt. Flinders.<sup>1</sup>VIII.—Trachyte, II. 4.1.4. Pantellerosse, por. 51, parish Esk.<sup>3</sup><sup>1</sup> Jensen, Proc. Linn. Soc., N.S.W., xxxiv.<sup>2</sup> Jensen, Proc. Linn. Soc., N.S.W., xxxd.<sup>3</sup> Ann. Rept. Agric. Chem., Qland, for 1914.

## (v.) DACITES.

Andesites are fairly common through the area, but in only one or two localities do dacites occur. These localities are near Bankfoot House in the Glass House Mountains district, and at Mount Alford.

The Glass House Mountains dacite which Jensen has fully described and analysed is certainly younger than the trachytic rocks with which it is associated, for it contains frequent inclusions of trachytic material which bears a close resemblance to the adjacent trachytic rocks. It is a variable rock, and in some microscopic sections appears to be a normal andesite while in the others it has abundant corroded quartz crystals. Chemically the rock is very similar to the dacite of Devonian age from the Macedon area in Victoria and more particularly the rock from the Willimigon-gong Creek near "Cheniston," "Upper Macedon."<sup>40</sup> The Macedon dacite is rather low in alkalis, particularly soda, but otherwise the resemblance is very close. Microscopically, however, there is a great difference, as not only is there a big difference in texture, but also in mineralogical composition. The Glass House Mountains rock covers an area of a few square miles, but it is apparently a thin flow.

Microscopically it is seen to be holocrystalline. It is perpatitic having occasional rounded phenocrysts of plagioclase set in a groundmass with an average grain-size of .15 mm. The groundmass is pilotaxitic and ophitic structure is common. The felspar present frequently shows zoning, and also simple and lamellar twinning; it ranges from labradorite to andesine, and occasional lath-shaped crystals of orthoclase are present. A feature of the plagioclase phenocrysts is the abundance of bright-green glass inclusions. Violet-coloured augite is frequent through the groundmass, and in some sections brown hornblende is seen, but augite is more abundant. Magnetite is abundant, and greenish chloritic alteration products are also plentiful. Quartz, when present, occurs as corroded phenocrysts. The Mount Alford material is somewhat similar to the Glass House Mountains material, but while the latter follows the trachytes the former precedes the rhyolite, for the rhyolite plugs at Glennie's Pulpit &c., on Mount Alford, intrude right through the andesites and dacites.

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<sup>40</sup> Geol. Surv., Vic., Bull. 24, pp. 17, 18.

TABLE IV.—DACITES.

| —                              |    |    |    |    | I.     | II.    | III. |
|--------------------------------|----|----|----|----|--------|--------|------|
| SiO <sub>2</sub>               | .. | .. | .. | .. | 62.15  | 62.56  | 61.3 |
| Al <sub>2</sub> O <sub>3</sub> | .. | .. | .. | .. | 16.73  | 16.60  | ..   |
| Fe <sub>2</sub> O <sub>3</sub> | .. | .. | .. | .. | 2.90   | 1.02   | ..   |
| FeO                            | .. | .. | .. | .. | 3.22   | 5.98   | ..   |
| MgO                            | .. | .. | .. | .. | 2.70   | 2.70   | ..   |
| CaO                            | .. | .. | .. | .. | 3.98   | 4.30   | 3.2  |
| Na <sub>2</sub> O              | .. | .. | .. | .. | 3.58   | 2.98   | 6.0  |
| K <sub>2</sub> O               | .. | .. | .. | .. | 2.81   | 2.57   |      |
| H <sub>2</sub> O+              | .. | .. | .. | .. | 1.06   | 0.68   | ..   |
| H <sub>2</sub> O—              | .. | .. | .. | .. | 0.14   | 0.18   | ..   |
| CO <sub>2</sub>                | .. | .. | .. | .. | 0.04   | nil    | ..   |
| TiO <sub>2</sub>               | .. | .. | .. | .. | 0.83   | 1.10   | ..   |
| P <sub>2</sub> O <sub>5</sub>  | .. | .. | .. | .. | p.n.d. | 0.17   | ..   |
| MnO                            | .. | .. | .. | .. | 0.12   | tr.    | ..   |
| NiO                            | .. | .. | .. | .. | 0.08   | ..     | ..   |
| S (FeS <sub>2</sub> )          | .. | .. | .. | .. | 0.11   | nil    | ..   |
| Total ..                       |    |    |    |    | 100.45 | 100.85 | ..   |
| Spec. Grav. ..                 |    |    |    |    | 2.61   | 2.773  | ..   |

*Norm.*

|             |    |    |    |    |       |       |    |
|-------------|----|----|----|----|-------|-------|----|
| Quartz      | .. | .. | .. | .. | 16.56 | 18.84 | .. |
| Orthoclase  | .. | .. | .. | .. | 16.68 | 15.01 | .. |
| Albite      | .. | .. | .. | .. | 30.39 | 25.15 | .. |
| Anorthite   | .. | .. | .. | .. | 19.74 | 20.57 | .. |
| Corundum    | .. | .. | .. | .. | 0.51  | 1.43  | .. |
| Diopside    | .. | .. | .. | .. | ..    | ..    | .. |
| Hypersthene | .. | .. | .. | .. | 8.78  | 15.12 | .. |
| Magnetite   | .. | .. | .. | .. | 4.17  | 1.39  | .. |
| Ilmenite    | .. | .. | .. | .. | 1.52  | 2.13  | .. |
| Pyrite      | .. | .. | .. | .. | 0.12  | ..    | .. |
| Apatite     | .. | .. | .. | .. | ..    | 0.31  | .. |

I.—Dacite, II. 4.3.4. Tonalose, near Bankfoot House, Glass House Mountains.<sup>1</sup>

II.—Dacite, II. 4.3.4. Tonalose, Willimigongong Ck., Upper Macedon, Victoria.<sup>2</sup>

III.—Dacite (partial analysis), Mt. Alford.<sup>3</sup>

<sup>1</sup> Jensen, Proc. Linn. Soc., N.S.W., xxxi, p. 169.

<sup>2</sup> Geol. Survey, Victoria, Bull. 24, pp. 17, 18.

<sup>3</sup> Govt. Analyst, Brisbane.

*Chemical Composition.*

The Glass House Mountains dacite is seen to be a normal dacite, and certainly sub-alkaline in nature. This is interesting, as it is found in the closest association with the very alkaline rocks such as the comendite of Mount Conowrin. The partial analysis of the Mount Alford rock shows that in a general way it is similar chemically to the Glass House Mountains dacite.

## (VI.) ANDESITES.

These have been recognised in several parts of the area, but in no place is there any very extensive development. It is a somewhat difficult matter to distinguish between the andesites and the andesitic basalts, as there are all gradations from andesites to olivine-basalts. The presence or otherwise of olivine, the relative amounts of augite and plagioclase, and the nature and habit of these have been taken as the main considerations in determining whether a flow is an andesite or not. Andesites were poured out during the first period of activity, but apparently towards the end of it. They are much more abundant in the last period of eruption, however, and in some places seem to have followed upon the trachytes; this is particularly the case in the most typical ones, as at the Main Range. On the other hand, andesite occurs at Mount Meerscham in the upper division, forming one of the most recent flows and resting on considerably more basic flows.

The Esk andesites really stand apart from the others as they are definitely of a porphyritic type and seem to be more basic representatives of the material which produced the rhyolites and trachytes occurring there; all of the other andesites, on the other hand, seem to be rather the acid representatives of the material which resulted in the extensive basaltic flows in their respective areas. The Esk andesites differ somewhat in their mode of occurrence also, for they occur as large intrusions through the ? Walloon coal-measures; the other occurrences are either as definite lava flows or sills. Apart from the Esk district, one finds andesites at the Main Range in the neighbourhood

of Spicer's Gap, on the eastern side of the range; at Mount Alford forming the base of the mountain; at Tamborine Plateau where there is an extensive and well-defined flow near the top of the plateau, and seen particularly well at the south-west end; at the summit of Mount Meerschauum; at the Lookout on MacPherson's Range where the Springbrook Plateau terminates; and at One Tree Hill near Point Danger. Just over the State border fence from One Tree Hill, similar material forms Observation Hill, and this, although in New South Wales, will be dealt with here.

It is found advisable to treat these rocks in two divisions, one embracing the augite-andesites from the Esk district, and the other the more normal sub-alkaline andesites.

### *Augite-Andesites.*

These occur near the Ottaba railway station, and also along the railway line towards Esk. Sections are seen where they intrude through the Walloon shales. At a cutting 42 miles 62 chains distant from Ipswich there is an excellent section showing an intrusion of andesite which has had a severe baking effect on the intruded shales. There are several intrusions seen along the line, and in the cutting immediately to the south of Ottaba there is a very large one, several hundreds of feet in width. The freshest material found was in portion 28v, parish of Biarra, and its description will serve for all this material. An analysis has been made of the andesite from portion 134, parish of Esk, and the sample was collected from the railway cutting. In the hand-specimen the rock is a light grey with abundant phenocrysts of augite which have a length of 2 or 3 mm.; around these there are accumulations of small granules of augite and this gives the rock a rather mottled appearance. In addition to the augite phenocrysts, there are plagioclase phenocrysts up to 2 mm. long. Microscopically the groundmass is seen to be hyalopilitic and to contain plagioclase, augite and magnetite. Here and there are rounded patches up to .75 mm. in diameter and these are made up of small granules of augite. The augite phenocrysts frequently show twinning and are usually

surrounded by a fringe of augite granules which have resulted from corrosion by the magma. (See Plate XIII., fig. 4.) It is noticeable that when an augite phenocryst impinges on another augite crystal or on a plagioclase phenocryst, the fringe does not exist, but occurs only along the junction of the augite with the groundmass. The fringe of granules is optically continuous with the crystal so that it is a resorption border.

The plagioclase phenocrysts are crystals of basic andesine,  $Ab_{35}An_{45}$  for the most part, although some of them show zoning with more acid shells; these phenocrysts are idiomorphic and have not been corroded. Magnetite occurs as inclusions in the augite, and also through the groundmass as very fine granules. The specific gravity of this rock is 2.75.

#### *Normal Andesites.*

These are all compact dark-coloured rocks and range from porphyritic to non-porphyritic. They are perpatite, and the phenocrysts are plagioclase, augite, and in some cases hypersthene, the latter occurring sparingly and having strongly marked resorption borders.

The plagioclase phenocrysts range from medium andesine,  $Ab_3An_2$ , to medium labradorite,  $Ab_2An_3$ , and do not, as a rule, show zoning. They show carlsbad, albite and pericline twinning, and are usually sub-idiomorphic or allotriomorphic; in size they range from 2 mm. to .4 mm. in length.

In several flows, particularly the Tamborine, Observation Hill, One Tree Hill and Mount Meerscham flows, the plagioclase phenocrysts appear to be medium andesine,  $Ab_3An_2$ , which is crowded with regularly arranged inclusions. These inclusions are frequently studded all through the crystal with the exception of a narrow band at the edge, which is quite clear. The inclusions in most cases consist of an opaque material, but in others they are small granules of augite. Both kinds of inclusion occur in the same crystal however, and this peculiar character of the plagioclase phenocrysts has also been noticed in some of the andesitic basalts. A great deal of variation exists in

the relative amount and size of the inclusions, but in the andesites from near Point Danger, in some cases, the phenocrysts seem almost wholly composed of very fine opaque inclusions.

The groundmass is in all cases hyalopilitic, and in some of the lavas it shows a definite fluxion structure. The crystals in the groundmass are plagioclase, augite, magnetite and ilmenite. The plagioclase usually shows simple twinning only, though in some, lamellar twinning is present. It is slightly more acid in the groundmass than in the phenocrysts, and ranges from medium andesine,  $Ab_{65}An_{35}$ , to basic andesine,  $Ab_{35}An_{65}$ . In size the laths range from .05 mm. to .15 mm. in length. Augite occurs in two generations in several rocks, but it is usually in very small grains in the groundmass.

The iron ores may occur as small granules or rod-like fragments .3 mm. long. The amount of glass in the groundmass varies greatly but it never exceeds the crystals in amount. It is usually a light brown in colour and crowded with trichites &c. Ophitic structure is not seen in any of the sections.

A few of the more representative rocks are here described.

*Specimen* 136.—*Locality*: Lookout, Springbrook Plateau, portion 84, parish of Numinbah. This andesite occurs as a flow and forms the summit of MacPherson's Range at the southern termination of the Springbrook Plateau. The rock is perpatitic and has phenocrysts of medium andesine ranging up to 2 mm. long, and violet-coloured sub-idiomorphic augite crystals up to .75 mm. in diameter, set in a hyalopilitic groundmass showing good fluxion structure.

The plagioclase in the groundmass ranges from .05 mm. to .3 mm. in length, and the augite is present in very fine granules. Very small granules occur abundantly through the section. The plagioclase phenocrysts show zoning in some cases, and twinning of the augite phenocrysts is seen occasionally. The specific gravity is 2.79. Name: *Andesite*.

An andesite similar to the above occurs on the old Warwick coach road on the east side of the Main Range.

*Specimen 7.*—*Locality:* One Tree Hill, near Point Danger. This occurs as a flow about 30 feet thick, capping the Palaeozoic schists. Parts of it seem somewhat agglomeratic, and rounded fragments of finer-grained, almost glassy, andesite are seen in it. One frequently finds quartzite and sandstone fragments which have been caught up in the flow. This material is apparently part of the same flow which occurs at Observation Hill or Razorback on the New South Wales side of the border. They are only separated by a few hundred yards and are at the same level, have the same thickness and general relationships, and are indistinguishable either in the hand-specimen or microscopically. The analysis of the Observation Hill rock may thus be regarded as holding for this rock. In the hand-specimen the rock is a very fine-grained, compact dark material which has occasional phenocrysts through it. Microscopically it shows a hyalopilitic groundmass with occasional phenocrysts of medium andesine,  $\text{Ab}_3\text{An}_2$ , augite and hypersthene. This is the only rock in which hypersthene has been definitely recognised, and it occurs in long crystals reaching 1.5 mm. in length, showing marked pleochroism and having a strong resorption border. The plagioclase phenocrysts which are sub-idiomorphic and range up to 1 mm. in length are remarkable for the numerous regularly arranged inclusions; in some cases the inclusions seem to form the major portion of the crystal. (*See* Plate XIII., fig. 6.) In almost all cases there is a narrow outside fringe of feldspar clear of inclusions, but as a rule the rest of the crystal contains them, except occasionally the central portion. The arrangement is in many cases zonal but this is not universal. The exact nature of the inclusions is difficult to determine, but in these feldspars they seem to be small patches of glassy matrix. The groundmass contains a large amount of brown glass which is not very evenly distributed, and here and there there are small patches free from augite and plagioclase. The feldspar shows lamellar twinning only as a rule, and it is a medium andesine, the laths of which have an average length of .15 mm. The augite granules are very fine and distributed evenly.

Iron-ore granules are not very abundant and they seem irregular in outline. The glass is a pale-brown colour and in some cases is thickly crowded with trichites &c., but in others it is comparatively free from them. The specific gravity is 2.57.

*Specimen 123.*—Locality: Portion 18, parish of Witherin. This flow forms a prominent cliff on the south-west end of Tamborine Plateau, and is well seen in a cliff in front of Mr. D. Lahey's house. The flow is more than 100 feet thick and gives rise to a precipice along the edge of the plateau. The rock is dark grey with large phenocrysts of a dark plagioclase. Microscopically it is seen to be hyalopilitic although the amount of glassy material is very small. The rock is perpatite and the phenocrysts are plagioclase and augite. The plagioclase is medium andesine,  $Ab_{55}An_{45}$ , and similar plagioclase containing inclusions as described in the andesine from near Point Danger occurs. The crystals containing the inclusions are not so abundant in this rock, and augite is frequently seen as the included material along with the glass. (*See Plate XIII. fig. 5.*) The augite phenocrysts are pale brown in colour and occur in allotriomorphic crystals up to 1 mm. in diameter. The groundmass is made up principally of small lath-shaped plagioclases showing lamellar twinning and having an extinction angle agreeing with medium andesine,  $Ab_3An_2$ . Abundant irregularly-shaped patches and rods of iron ores occur through the rock. The specific gravity is 2.64.

TABLE V.—ANDESITES.

|                                      | I.     | II.    | III.   | IV.   | V.     |
|--------------------------------------|--------|--------|--------|-------|--------|
| SiO <sub>2</sub> .. ..               | 61.24  | 57.62  | 54.10  | 56.52 | 59.59  |
| Al <sub>2</sub> O <sub>3</sub> .. .. | 14.33  | 13.63  | 13.42  | 17.55 | 17.31  |
| Fe <sub>2</sub> O <sub>3</sub> .. .. | 1.81   | 5.41   | 4.06   | 3.14  | 3.33   |
| FeO .. ..                            | 6.09   | 5.15   | 7.43   | 4.86  | 3.13   |
| MgO .. ..                            | 3.45   | 2.86   | 4.43   | 2.51  | 2.75   |
| CaO .. ..                            | 5.07   | 5.57   | 7.97   | 5.50  | 5.80   |
| Na <sub>2</sub> O .. ..              | 3.75   | 3.38   | 3.81   | 4.82  | 3.58   |
| K <sub>2</sub> O .. ..               | 3.13   | 3.07   | 1.15   | 1.90  | 2.04   |
| H <sub>2</sub> O+ .. ..              | 0.28   | 1.54   | 0.88   | 2.45  | 1.26   |
| H <sub>2</sub> O- .. ..              | 0.17   | nil    | nil    | 0.25  |        |
| CO <sub>2</sub> .. ..                | ..     | ..     | ..     | ..    | ..     |
| TiO <sub>2</sub> .. ..               | 0.52   | 1.75   | 2.35   | tr.   | 0.77   |
| P <sub>2</sub> O <sub>5</sub> .. ..  | 0.51   | 0.40   | 0.46   | 0.22  | 0.26   |
| MnO .. ..                            | tr.    | 0.26   | 0.30   | 0.13  | 0.18   |
| Total .. ..                          | 100.35 | 100.64 | 100.36 | 99.85 | 100.00 |
| Spec. Grav. ..                       | 2.57   | 2.64   | 2.79   | 2.75  | ..     |

## Norm.

|                   |       |       |       |       |    |
|-------------------|-------|-------|-------|-------|----|
| Quartz .. ..      | 10.74 | 12.42 | 6.78  | 4.68  | .. |
| Orthoclase .. ..  | 18.35 | 18.35 | 6.67  | 11.12 | .. |
| Albite .. ..      | 31.96 | 28.82 | 31.96 | 40.35 | .. |
| Anorthite .. ..   | 12.79 | 12.51 | 16.12 | 20.85 | .. |
| Diopside .. ..    | 7.47  | 9.89  | 16.45 | 4.61  | .. |
| Hypersthene .. .. | 13.93 | 4.82  | 9.87  | 10.48 | .. |
| Magnetite .. ..   | 2.55  | 7.89  | 6.03  | 4.41  | .. |
| Ilmenite .. ..    | 0.91  | 3.34  | 4.41  | ..    | .. |
| Apatite .. ..     | 1.34  | 1.01  | 1.34  | 0.34  | .. |

I.—Andesite, II. 4.2.4. Dacose, Observation Hill, Tweed Heads.<sup>1</sup>

II.—Andesite, II. 4.2.3(2). Adamellose, por. 18, parish Witherin, Tamborine Plateau.<sup>1</sup>

III.—Andesite, III.(II.) 5.3.4. Camptonose, Lookout, Springbrook Plateau.<sup>1</sup>

IV.—Augite-Andesite, II. 5.3.4. Andose, Ottaba, por. 124, parish Esk.<sup>1</sup>

V.—Average analysis of 87 Andesites.<sup>2</sup>

<sup>1</sup> Ann. Report Agric. Chem., Q'land, for 191

<sup>2</sup> Daly, Igneous Rocks, p. 28.

*Specimen 125.*—Uppermost flow, Mount Meerschaum. This is a very fine-grained dark-grey rock which is almost free from phenocrysts. Microscopically it shows a typical hyalopilitic groundmass with very occasional corroded phenocrysts of plagioclase containing glass inclusions. The groundmass is extremely fine-grained, and contains a rather larger amount of small granules of the iron ores than usual.

### *Chemical Composition.*

In the case of the three normal andesites there is a lack of alumina, but a corresponding richness in the iron-oxides, particularly ferrous oxide. The total of alumina and iron-oxides gives a normal value. The only other respect in which they are at all abnormal is in the slightly higher value for potash in the Tamborine Plateau and Observation Hill rocks than is usual for the andesites; the Springbrook rock seems to be more normal in that respect.

In the augite-andesite from Ottaba the alumina value is normal, but this rock is characterised by a relatively high soda value.

### (VII.) BASALTS.

These are the most abundant rocks and they form the bulk of the material extruded in both the first and last periods of eruption.

The accumulated thickness of the flows of basalt in some cases reaches 1,500 feet and it is made up of a number of small flows one on top of the other. The flows vary a great deal in thickness, and 120 feet is the maximum thickness noted for any one flow, but 20 feet or 30 feet is a very common thickness.

The bulk of the material is believed to have been poured out as surface flows, not intruded as sills; close observations were made in the field, and only sills of a very minor nature were encountered. Microscopic evidence does not help one in this direction, as there is great variation in the texture, and ophitic structure is developed to a large extent in undoubted lava flows. It is impossible to distinguish between the basalts of the lower and upper divisions, as they do not differ chemically, macroscopically

or microscopically to a sufficient extent to enable one to do so. Also macroscopical investigations fail to distinguish between the andesites and basalts, except possibly by specific gravity determinations. The basalts range from 2.74 to 2.92 in specific gravity, while the andesites range from 2.57 to 2.79; so that in many cases it would be possible to judge whether the rock was an andesite or a basalt.

It has been, however, found impossible to distinguish them in the field, and the whole series of andesites and basalts have been coloured the same on the sketch-map; also in many cases it is found that successive flows pass from one to the other.

At Spicer's Peak there occurs an oligoclase-basalt which is very different from any other known basaltic rock in the area. It is similar chemically, mineralogically and in its appearance and weathering, to the mugearite described by Harker<sup>41</sup> from Druim na Crìche in Skye.

While one finds in certain areas great developments of olivine-basalts and basalts, there is also an extensive development of andesitic-basalts. The andesitic-basalts have the texture of andesites with a certain percentage of glassy base while the olivine-basalts are holocrystalline.

These rocks are distributed over the whole of the area, and they are found at all levels from 4,100 feet above sea-level down to sea-level.

Many of the lavas are amygdaloidal, and in the case of several flows on the Main Range in particular, they have abundant zeolites filling the cavities. The zeolite chabazite is the most abundant; several other minerals occur in the cavities, but are of minor importance when compared with chabazite. The rock containing these cavities in most cases appears perfectly fresh, and these minerals have apparently been formed during the cooling period of the rock, and they do not represent ordinary secondary minerals. Analcite also has been noticed.

Generally speaking, the flows are not porphyritic, although very porphyritic flows do occasionally occur, and

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<sup>41</sup> Op. cit., pp. 264, 265.

in these latter flows plagioclase phenocrysts up to half an inch in length may occur. Olivine also occurs as phenocrysts in some of the lavas, and in particular at Toowoomba and Spring Bluff.

In crystallinity the rocks are either holocrystalline or hypocrySTALLINE. As far as the grain-size is concerned, in the groundmass it varies from extremely fine to medium, although a fine groundmass averaging .1 mm. in diameter is the most common, and in the phenocrysts there are plagioclase crystals ranging up to 14 or 15 mm. long, although the average length of plagioclase phenocrysts is 2 mm. The groundmass is either pilotaxitic or hyalopilitic; fluxion structure may be well developed, but ophitic structure is very common and indicates that in most cases the lavas had come to rest before the augite crystallised out. The minerals present as phenocrysts are plagioclase and olivine; the former shows simple and broad lamellar twinning as a rule and ranges from medium andesine,  $Ab_3An_7$ , to acid labradorite,  $Ab_{43}An_{57}$ , although basic andesine is the most common. Zoning is seen rarely but it has been noticed in some of the large phenocrysts in an olivine-basalt from Lamington Plateau. Olivine occurs frequently as phenocrysts and it may occur up to 2 mm. in length. It is usually sub-idiomorphic to rounded and alters in several different ways; the alteration to the red lamellar mineral iddingsite is very well seen in some of the Lamington basalts. The minerals of the groundmass are plagioclase, augite, olivine and iron ores. The plagioclase crystals usually show albite twinning, though only simple twinning is seen in very fine lath-shaped crystals.

Usually the groundmass feldspar is more acid than the phenocrysts, and ranges from acid andesine,  $Ab_7An_3$ , which is fairly common, to medium labradorite,  $Ab_2An_8$ ; the most abundant plagioclase is andesine.

The augite appears either colourless in thin sections or as the violet-tinted titaniferous variety. It occurs in granules, sub-ophitic patches, or as definite ophitic patches. It is frequently a matter of great difficulty to distinguish between the colourless augite and olivine in the granules. Hypersthene has not been seen in any of the basalts.

Olivine is very abundant in many of the rocks and occurs as rounded granules; this mineral occurs in two generations quite frequently. Augite has not been found in two generations in the basalts, nor has it been found in them showing twinning. Olivine may occur sparingly in the andesitic basalts, but augite is extremely abundant.

Both magnetite and ilmenite occur in great abundance, as small granules or crystals in the groundmass, and frequently as inclusions in all the other minerals. In some of the finer-grained basalts there is a great abundance of small granules of either ilmenite or magnetite, but it is not easy to determine which of them. The Mount Lindsay basalt is particularly rich in iron ore, and in all probability it is mostly ilmenite as it contains 12.15 per cent. FeO, 1.78 per cent.  $\text{Fe}_2\text{O}_3$ , and 3.08 per cent.  $\text{TiO}_2$ . The iron ore occurs frequently as inclusions in olivine, augite and plagioclase, and while many of the crystals are undoubtedly magnetite from their shape, it is usual to find them quite allotriomorphic, and frequently in long thin rods sometimes .75 mm. long and cut through by felspar laths. Apatite is not often seen although it is undoubtedly present in all the rocks to a small extent. The order of crystallisation is always the same: iron-ore, olivine if present, felspar, augite.

A very large number of micro-sections have been examined, and descriptions of a few of the more typical ones are given below.

*Specimen 86.*—Lamington Plateau. This is a compact porphyritic basalt in which phenocrysts of plagioclase and olivine may be seen. Microscopically it is perpatite with phenocrysts of acid labradorite showing carlsbad and broad lamellar twinning.

These phenocrysts are idiomorphic, do not appear to have been corroded at all, and range up to 2 mm. in length. Olivine phenocrysts which are roughly idiomorphic in outline and up to 1 mm. in length are abundant. They are altering into the red lamellar mineral iddingsite, and in all cases have a thin red band around them where the alteration has gone on. (*See Plate XIV., fig. 2.*) The groundmass is holocrystalline and shows good fluxion structure; the augite is distributed abundantly through

the section as sub-ophitic patches approximately .2 mm. in diameter. Small olivine granules which have been altered occur sparingly through the section. Plagioclase occurs in lath-shaped crystals averaging .3 mm. in length, and it is either acid labradorite or basic andesine. The iron-ore minerals occur both as small granules about .04 mm. in diameter, and as thin rods about 2 mm. long.

The above rock is typical of most of the basalts on Lamington Plateau, although there is a great variation in the amount of olivine present, and also fluxion structure is not always present.

Phenocrysts of olivine with large crystals of plagioclase moulded on them are seen in some sections of these rocks.

*Specimen 94.*—Locality: Chinghee Creek, portion 69, parish of Telemon. This is one of the flows from the first eruption, and it is found below the rhyolite agglomerate. In the hand-specimen it is a compact rock, which shows occasional plagioclase phenocrysts. When examined microscopically it is seen to be holocrystalline with very occasional plagioclase phenocrysts set in a groundmass with plagioclase averaging .5 mm. in length, and showing a rough fluxion structure. The plagioclase is both medium and basic andesine, but the latter is the more abundant. (*See* Plate XIV., fig 3.) Ophitic structure is very well developed, and the enclosing augite by its violet colour is apparently the titaniferous variety.

Olivine granules which are altering into serpentine are abundant, and they have an average size of .25 mm. in diameter. Allotriomorphic grains and rods of iron-ore are plentiful. The specific gravity of this rock is 2.76 and an analysis is given. Name: *Basalt*.

*Specimen 92.*—Chinghee Creek, portion 67v, parish of Telemon. This is one of the flows from the third period of eruption, and rests on top of the rhyolite agglomerate. It comes from Lahey's Cutting. The flow is very much weathered, and it is a matter of difficulty to get a fresh specimen. This rock is rather finer-grained than the previous one and contains more olivine, being particularly

noted for the abundant and large phenocrysts of this mineral. These are usually sub-idiomorphic and have an average diameter of 1 mm.

The plagioclase, which occurs only in the groundmass is basic andesine,  $Ab_{35}An_{45}$ . An analysis of this rock is given. The specific gravity is 2.87. Name: *Olivine Basalt*.

*Specimen 221.*—Locality: 3,000 feet level, south-east side of Mount Lindsay. This represents the uppermost flow of the lower division of basic rocks and lies directly underneath the pitchstone and rhyolite dome of Mount Lindsay. In the hand-specimen it is seen to be extremely fine-grained. It has a hyalopilitic groundmass showing a very good fluxion structure. (See Plate XIV., fig. 6.) It has small porphyritic crystals of plagioclase and olivine about 1 mm. long, but these phenocrysts are not plentiful. The groundmass consists of felspar microlites, very small granules of augite, and a great abundance of very fine granules of iron-ore. This is probably largely ilmenite as the norm shows 5.93 per cent. of ilmenite and 2.55 per cent. magnetite. Occasional rectangular patches of magnetite .05 mm. in diameter are seen. A very similar rock to this is met among the lower basalts on Christmas Creek, near Burge's Crossing, and on the western termination of Buchanan's tramline. The specific gravity is 2.79. Name: *Basalt*.

*Specimen 225.*—Locality: 2,400 feet level, south-east side of Mount Lindsay. This flow is one of the lower division, and occurs somewhat below the rock just described. It differs considerably, however, in being holocrystalline and it does not exhibit the same fluxion structure. The olivine is nearly all altered and the augite, which is titaniferous, occurs in definite ophitic patches. Name: *Basalt*.

*Specimen 112.*—Locality: Coulson's Creek, portion 51v, parish of Clumber. This occurs as a dyke, 2 feet wide, cutting through a coal-seam which it has coked on either side. It is indistinguishable in the hand-specimen from many of the surface flows.

It is holocrystalline, and is made up of very abundant

thin lath-shaped plagioclase and augite crystals up to .5 mm. long, set in a pilotaxitic groundmass of augite, plagioclase, olivine and iron-ore.

The plagioclase shows lamellar twinning and is acid labradorite,  $Ab_{45}An_{55}$ , while the augite is seen to have a marked violet tint. The iron-ore which is very abundant and more or less aggregated into patches is seen to consist largely of octahedral crystals, so that it is largely magnetite. The olivine occurs as rounded granules averaging .15 mm. in diameter. It is noticeable that ophitic structure is entirely absent, also the "granulitic" structure which one finds in some of the flows and which indicates movement after crystallisation. Name: *Dolerite*.

*Specimen 124.*—Locality: Canungra Creek, portion 21, parish of Sarabah. This is a flow which belongs to the first division of basic rocks, and is the only one of this division in which columnar structure has been seen. The rock in the hand-specimen is seen to contain abundant phenocrysts of plagioclase and occasional crystals of olivine. Microscopically it is hypocrystalline and consists of sub-idiomorphic crystals of medium labradorite,  $Ab_2An_3$ , in size up to 3 mm. long but averaging 1.5 mm., and rounded and corroded phenocrysts of olivine averaging 1 mm. in diameter, set in a groundmass of plagioclase, olivine, augite, iron-ore and a brown glass. The augite does not appear in two generations like olivine does. The plagioclase phenocrysts in many cases are very well zoned, and the outer fringes are rather acid andesine. The plagioclase in the groundmass averages .3 mm. in length and is fairly basic andesine.

The brown glass is very cloudy and seems crowded with small dots of iron-ore. The latter occurs as rounded patches and as rods up to .2 mm. in length. This rock is mainly characterised by the zoning of the plagioclase phenocrysts. Name: *Andesitic basalt*.

*Specimen 116.*—Summit Spicer's Peak. This rock is a very compact dark-greenish one, and shows very occasional phenocrysts of olivine. Microscopically it has a cryptocrystalline groundmass which seems to be mainly felspar, although granules of augite can be seen. (*See*

Plate XIV., fig. 5.) Iron-ore is abundant and occurs both as allotriomorphic granules and as minute octahedra. Olivine occurs as phenocrysts and is largely altered to serpentine. These phenocrysts range in size up to 1 mm. in length. This rock is somewhat peculiar chemically, and although its felspar is indeterminable, it is probably oligoclase.

Another micro-section of the same flow shows somewhat more crystalline characters, and the microlites can be determined as oligoclase. Dr. Woolnough<sup>42</sup> described this rock and determined it as a porphyritic olivine-basalt. The author has seen sections of the same material that he dealt with, and while agreeing with his description, would prefer to call this rock oligoclase-basalt. The rock has a few phenocrysts of acid labradorite up to 2 mm. long, and olivine largely altered to serpentine set in a pilotaxitic groundmass of oligoclase, granules of augite, granules of iron-ore and small patches of olivine and serpentine. Small needles of apatite are abundant.

This rock is rather different from any of the others in the area, and it has certain similarities to the mugearites described by Harker.<sup>43</sup> In its mode of weathering, fissile character and specific gravity of 2.74, it is similar. Chemically it is characterised by low magnesia and low lime, by high alkalis, both soda and potash; also it has the characteristic high value for phosphoric pentoxide.

This rock may be regarded as much allied to the mugearites described by Harker and probably it is best described as oligoclase-basalt.

*Specimen 139.*—Municipal Quarries, Toowoomba. This rock shows magnificent columnar structure, and it is very fine-grained, breaking with a conchoidal fracture. Phenocrysts of olivine are frequently seen in the hand-specimen, and in some cases "pockets" are found, several inches in diameter. These are accumulated masses of small olivines which are eagerly sought for gem purposes. Microscopically the rock shows abundant phenocrysts of

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<sup>42</sup> Proc. Roy. Soc., N.S.W., xlv., p. 158.

<sup>43</sup> Skye Memoir.

olivine which are usually rounded, but occasionally subidiomorphic. These range from about 4 mm. down to very small granules, although occasionally individual phenocrysts may be nearly half an inch in length. The groundmass is pilotaxitic and is composed of augite, plagioclase, olivine, magnetite and ilmenite.

Plagioclase is much less abundant, and olivine much more abundant in this rock than in any other rock examined. The plagioclase is difficult of determination, but is possibly an acid andesine; it occurs as lath-shaped crystals averaging 0.4 mm. in length. The specific gravity is 2.88. Name: *Olivine-basalt*.

The olivine-basalt at Picnic Point, Toowoomba, is very similar to this rock.

*Specimen 218.*—Locality: Summit of Hip Roof Range, south of Laidley. This rock in many respects is similar to the Toowoomba basalt, and has an abundance of olivine, both as phenocrysts and granules in the groundmass. It is coarser-grained than the Toowoomba rock, and the olivine is seen decomposing into iddingsite.

Titaniferous augite is also fairly abundant through the groundmass. This rock differs considerably from one at a lower level in the same locality at Deep Creek. The Deep Creek rock is mineralogically the same, but has well-developed ophitic structure. Name: *Olivine-basalt*.

*Specimen 11.*—Locality: Point Danger. This occurs as the top flow, which is about 60 feet thick. It has been extensively quarried and used for forming the river walls along the Tweed River.

In the hand-specimen, large phenocrysts of a dark coloured plagioclase showing both carlsbad and lamellar twinning are abundant.

Microscopically the rock is seen to have a holocrystalline groundmass of plagioclase, augite and magnetite in which are set the phenocrysts of acid labradorite,  $Ab_{45}An_{55}$ . (See Plate XIV., fig. 1.) The phenocrysts range up to 10 mm. in length and have somewhat broken edges. In some of them, regularly arrayed inclusions of

a brown colour are seen. The plagioclases in the ground-mass are lath-shaped, average 0.4 mm. in length, and have an extinction angle which indicates acid andesine.

The augite occurs in ophitic patches about 1 mm. in diameter. The iron-ore occurs in granules and in rods, the latter averaging .4 mm. in length. Olivine is not present.

Underlying this rock there is another flow, which rests on Palæozoic rocks. Between the two flows there are lenticular patches of common black opal<sup>44</sup> which represents altered diatomaceous earth. Also, in the lower part of the flow, casts of trees several feet in length and up to a foot in diameter are seen; these are always horizontal. The lower flow is somewhat similar in the hand-specimen, but it has fewer phenocrysts of felspar and microscopically it is very different, as it is hyalopilitic and much finer-grained. This latter basalt is in many respects similar to the basalt at Fingal Point, which is about a mile away and at the same level.

*Specimen 4.*—Locality: Burleigh Heads. This forms a capping on the Palæozoic schists, and supports a sub-tropical vegetation. It is typical of the basalt rocks in this locality and is characterised by magnificent columnar structure. The columns are about 4 feet in diameter, and in many cases are 40 feet long.

In the hand-specimen occasional phenocrysts, about half an inch long, of very clear plagioclase are seen. Under the microscope the rock is seen to be hyalopilitic with a fluxional arrangement of the felspars.

The plagioclase laths are about .05 mm. in length, and are of two varieties, acid labradorite which is most abundant, and acid andesine which occurs less frequently and in somewhat square prisms.

Augite occurs in sub-ophitic rounded patches but occasionally in long patches 1 mm. in length. Iron-ore is abundant, and occurs mainly as irregular granules. An analysis of this rock is given. Specific gravity 2.87. Name: *Andesitic Basalt*.

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<sup>44</sup> E. W. Skeats, Proc. Roy. Soc., Q'land, xxvi. (1914).

The basalt at Cut Hill near C'clangatta is very similar indeed to this rock.

*Specimen 237.*—Quarries, Bundamba. This represents one of the most recent flows in the whole of the area, and is largely quarried for road-making purposes.

It is a compact non-porphyrific basalt, and under the microscope it is seen to be holocrystalline. The brown glass which is studded with rod-shaped crystals of iron-ore is not very abundant. (*See Plate XIV., fig. 4.*) The rock is rather coarse in texture, the plagioclase laths averaging 0.6 mm. in length, and the augite which occurs in ophitic patches well developed may extend to 1.5 mm. in length.

Olivine is abundant, and occurs in rounded crystals up to 1 mm. in diameter. The plagioclase is an acid labradorite.

This rock is certainly a flow, and it shows ophitic structure better developed than in any other rock examined. Specific gravity 2.92. Name: *Basalt*.

### *Basaltic Tuffs and Agglomerates.*

These do not occur to any great extent, and are really of very limited occurrence. At Christmas Creek, between Lamington and Lamington Glen, basaltic agglomerate which is made up of rounded boulders and scoriaceous fragments occurs immediately beneath the acid agglomerates of the area. There is no great thickness and it represents the surface of the lower basic rocks. The surface material at Spicer's Peak, on its extreme eastern end, is also agglomeratic in nature, and represents in that locality the most recent material which is preserved, of the upper division of the basic rocks. It is probable that the explosive element resulting in the agglomerate developed here and also at Christmas Creek when the fissures which had served as the extruding channels became choked up.

Near Toowoomba there are very large accumulations of basaltic tuff, and numerous sections through it are seen

along the railway cuttings, between Harlaxton and Spring Bluff. It is well bedded, loosely aggregated, and in a very weathered condition.

In the Municipal Quarries at Toowoomba, distinct evidence of central vents is present, and it is in this district only that evidence of prolonged and important extrusions of basic material from eruptions of the central type is found.

#### *Chemical Composition.*

The analysis of the oligoclase-basalt from Spicer's Peak is seen to be very similar to the mugearite analysis. It is richer in silica and poorer in ferric oxide, but the lime, magnesia, total alkalies, titania and phosphorus pentoxide are very similar. The Spicer's Peak rock is poorer in soda but correspondingly richer in potash. There is a close similarity between the basalt from Cooper's Plains and the lower basalt in portion 69 at Chinghee Creek. This similarity is interesting as the Cooper's Plains basalt represents one of the most recent flows of the area, and the Chinghee Creek flow one of the earliest, as it belongs to the lower division.

The basalts from Pittsworth and Mount Lindsay are also very similar. Chemical distinctions cannot be made between the rocks of the lower and upper divisions, nor can they be distinguished microscopically.

TABLE VI.—BASALTS.

|  | I.    | II.              | III.  | IV.    | V.(a) | VI.   | VII.             | VIII.(a) | IX.   | X.(a)  | XI.    | XII.(a) | XIII. | XIV |
|--|-------|------------------|-------|--------|-------|-------|------------------|----------|-------|--------|--------|---------|-------|-----|
| SiO <sup>2</sup> .. .. .               | 52.05 | 49.24            | 52.24 | 51.80  | 51.86 | 51.69 | 50.78            | 50.27    | 50.24 | 49.00  | 49.32  | 48.96   | 48.55 | 47  |
| Al <sub>2</sub> O <sub>3</sub> .. .. . | 15.50 | 15.84            | 16.52 | 16.63  | 18.56 | 13.16 | 15.16            | 12.50    | 16.59 | 15.79  | 18.11  | 16.58   | 12.45 | 14  |
| Fe <sub>2</sub> O <sub>3</sub> .. .. . | 2.62  | 6.09             | 4.52  | 2.72   | 0.38  | 3.99  | 2.36             | 2.44     | 2.72  | 4.52   | 2.51   | 1.95    | 3.60  | 1.  |
| FeO .. .. .                            | 7.29  | 7.18             | 6.61  | 7.91   | 10.69 | 8.65  | 10.01            | 8.18     | 8.35  | 6.25   | 4.86   | 8.62    | 10.13 | 12. |
| MgO .. .. .                            | 2.89  | 3.02             | 3.55  | 5.34   | 3.72  | 6.84  | 4.43             | 10.25    | 5.14  | 5.77   | 8.05   | 7.97    | 7.64  | 5   |
| CaO .. .. .                            | 4.92  | 5.20             | 8.20  | 8.38   | 5.77  | 8.41  | 6.46             | 7.52     | 8.70  | 9.12   | 8.90   | 8.75    | 7.58  | 7   |
| Na <sub>2</sub> O .. .. .              | 4.46  | 5.21             | 3.28  | 3.89   | 3.30  | 2.76  | 3.54             | 3.29     | 3.54  | 3.24   | 1.90   | 3.08    | 3.20  | 3   |
| K <sub>2</sub> O .. .. .               | 2.94  | 2.10             | 1.48  | 6.29   | 2.10  | 0.45  | 2.20             | 1.42     | 0.40  | 0.89   | 3.36   | 0.01    | 1.75  | 1   |
| H <sub>2</sub> O+ .. .. .              | 2.18  | 1.61             | 0.65  | 0.88   | 0.56  | 1.00  | 1.32             | 1.11     | 1.84  | 1.36   | 1.80   | 1.18    | 1.66  | 1   |
| H <sub>2</sub> O- .. .. .              | 0.75  | 1.08             | 0.58  | 1.10   | 0.24  | 0.55  | 0.75             | 0.46     | 1.02  | 1.28   | 0.28   | 0.66    | 0.31  | 0   |
| CO <sub>2</sub> .. .. .                | ..    | ..               | ..    | ..     | ..    | ..    | 0.01             | ..       | ..    | ..     | ..     | ..      | ..    | ..  |
| TiO <sub>2</sub> .. .. .               | 1.84  | 1.84             | 1.44  | 0.82   | 0.70  | 1.70  | 2.00             | 2.26     | 0.72  | 1.08   | 0.60   | 0.81    | 1.34  | 3   |
| P <sub>2</sub> O <sub>5</sub> .. .. .  | 1.15  | 1.47             | 0.80  | 0.26   | 1.44  | 0.28  | 0.34             | 0.60     | 0.41  | 0.43   | 0.27   | 0.34    | 0.61  | 0   |
| MnO .. .. .                            | 0.14  | 0.29<br>&c. 0.23 | tr.   | 0.23   | 0.18  | 0.14  | 0.11<br>&c. 0.30 | 0.18     | 0.29  | 0.12   | 0.47   | 0.14    | 0.25  | 0.  |
| Total .. .. .                          | 99.69 | 100.46           | 99.87 | 160.25 | 99.50 | 99.62 | 100.40           | 100.51   | 99.96 | 100.65 | 100.37 | 99.95   | 99.10 | 99. |
| Spec. Grav. .. .. .                    | 2.74  | 2.79             | 2.87  | ..     | ..    | 2.92  | ..               | 2.88     | 2.81  | 2.70   | 2.80   | 2.87    | ..    | 2   |

(a) Slight alterations in MnO and TiO<sub>2</sub> have subsequently been made by Agric. Chemist.

Norm.

|                     | I.   | II.   | III.  | IV.   | V.    | VI.   | VII.  | VIII. | IX.   | X.    | XI.   | XII.  | XIII. | XIV.  |
|---------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Quartz <sup>1</sup> | 0.96 | 12.23 | 9.06  | 0.42  | 2.22  | 5.82  | 12.79 | 8.84  | 0.06  | 2.10  | 19.46 | 5.56  | 10.01 | 9.45  |
| Orthoclase          | ..   | ..    | 8.90  | 1.07  | 12.23 | 2.22  | ..    | ..    | 2.22  | 5.56  | ..    | ..    | ..    | ..    |
| Albite              | ..   | ..    | 27.77 | 33.01 | 27.77 | 23.58 | 29.87 | 27.77 | 29.87 | 27.25 | 16.24 | 26.20 | 27.25 | 32.49 |
| Anorthite           | ..   | ..    | 25.85 | 29.97 | 20.29 | 22.24 | 10.18 | 15.20 | 29.86 | 25.85 | 30.86 | 28.36 | 14.48 | 16.68 |
| Nepheline           | ..   | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    |
| Corundum            | ..   | ..    | ..    | ..    | 3.47  | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    |
| Diopside            | ..   | ..    | 7.04  | 10.73 | ..    | 14.46 | 9.22  | 14.95 | 10.08 | 13.56 | 9.36  | 10.88 | 16.85 | 7.86  |
| Hypersthene         | ..   | ..    | 11.00 | 19.98 | 27.65 | 19.90 | 15.15 | 11.90 | 20.23 | 12.40 | 3.12  | 6.97  | 7.54  | ..    |
| Olivine             | ..   | ..    | ..    | ..    | ..    | ..    | 5.88  | 11.52 | ..    | ..    | 13.80 | 15.00 | 13.15 | 15.04 |
| Akermanite          | ..   | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | ..    | 5.66  |
| Magnetite           | ..   | ..    | 6.50  | 3.94  | 0.70  | 5.80  | 3.48  | 3.48  | 3.94  | 6.50  | 3.71  | 2.78  | 5.34  | 2.55  |
| Ilmenite            | ..   | ..    | 2.74  | 1.52  | 1.37  | 3.10  | 5.02  | 4.41  | 1.44  | 3.80  | 1.22  | 1.52  | 2.43  | 5.98  |
| Apatite             | ..   | ..    | 2.02  | 0.97  | 3.86  | 0.67  | 0.67  | 1.34  | 1.01  | 1.01  | 0.67  | 0.67  | 1.34  | 2.02  |

<sup>1</sup> I.—Oligoclase-Basalt, II. 5.2.4. Akerosse, Spicer's Peak, Main Range<sup>2</sup> II.—Mugearite, II. 5.2.4. Akerosse, Drum na Griche, I. of Skye<sup>3</sup> III.—Andesitic-Basalt, II. 5.3.4. Andose, Burleigh Heads<sup>4</sup> IV.—Basalt, II. 5(4), 5. Beerbadoose, por. 25/26, par. Purga<sup>5</sup> V.—Basalt, II. 5.3.4. Andose, por. 1.24, par. Purga<sup>6</sup> VI.—Basalt, III. 5.3.5. Ormose, Bundamba<sup>7</sup> VII.—Olivine-Basalt, III. 5.3.4. Camptonose, Fingal Pt., Tweed Hds<sup>8</sup> VIII.—Olivine-Basalt, III. 5.3.4. Camptonose, Municipal Quarries, Two-woomba<sup>9</sup> IX.—Basalt, III. (II.) 5.3(4) 5. Auvergnose-Ormose, Walkeden's Quarries, Cooper's Plains<sup>10</sup> X.—Basalt, III. (II.) 5.3.4. Camptonose, Chinghee Creek, por. 69, par. Telemont<sup>11</sup> XI.—Basalt, II. 5(3), 4.3. Shoshonose-Hesose, Red Hill, Ipswich<sup>12</sup> XII.—Olivine-Basalt, III. (II.) 5.4(3) 4. Auvergnose, Chinghee Creek, por. 67, par. Telemont<sup>13</sup> XIII.—Basalt, III. 5.3.4. Camptonose, Pittsworth<sup>14</sup> XIV.—Basalt, III. 5.3.4. Camptonose, 3,000' level, Mt. Lindsay<sup>1</sup> Ann. Rep. Agric. Chem., Q'land, 1912.<sup>2</sup> Ann. Rep. Agric. Chem., Q'land, 1913.<sup>3</sup> Ann. Rep. Agric. Chem., Q'land, 1914.<sup>4</sup> Rec. Geol. Surv., N.S.W., vol. 7, p. 304.<sup>5</sup> Tertiary Igneous Rocks of Skye, p. 263.

## VI. RELATIONSHIPS OF THE VOLCANIC ROCKS TO ONE ANOTHER.

Thirty-five complete chemical analyses of the volcanic rocks are available. These, which may be regarded as representative of the extruded material, have all been tabulated earlier in this paper. For purposes of better comparison, however, the accompanying table has been drawn up, and all the analyses have been recalculated to 100 per cent. after the subtraction of the water &c.

In the list of rocks analysed, there are representatives of the upper, middle and lower divisions, and also of the alkaline and sub-alkaline types. An examination of the table shows that the rocks range from acid to basic, and the order followed is simply one of silica percentage in the recalculated analyses. The numbers which the rocks are here given are those used for the rocks in the variation diagrams.

Owing to the great extent of volcanic rocks, their stratigraphical relationship to one another, the denudation which has gone on, and the great difficulty of mapping-in boundaries owing to the ruggedness of the country, it is a matter of difficulty to accurately estimate the relative volumes of the different outpourings. But as the important masses are all known and the average thicknesses of the various divisions can be determined it is possible to make an estimate as to the general ratios of the volumes of the extrusions.

This estimate used in conjunction with the chemical analyses enables one to make an approximation to the mean average composition of the extruded material.

It is believed that all the volcanic rocks of the area are magmatically related, and that the parent magma from which they have been derived had the composition of a nearly normal andesite.

### *Average Composition of the Volcanic Rocks of the Upper Division.*

Fourteen analyses of lavas known definitely to belong to this division have been used. The rocks analysed are

representatives of all parts of the area, and it is notable that there are no representatives, belonging to this division, of the definitely alkaline series. The author is of the opinion that a combination of the analyses in equal proportions furnishes the most reliable basis for a determination of the mean average composition of the lavas. The analyses used were those of lavas numbered 18, 20, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34.

*Average Composition of the Volcanic Rocks of the  
Middle Division.*

This estimation is rather more complex than the above, and seventeen analyses were used.

The rhyolitic rocks in the southern part of the area, the rocks of the Esk district, and the alkaline rocks from the Glass House Mountains, Mount Flinders and Main Range areas, constitute the representatives of this division.

It is estimated that rocks of this division in the Main Range, the Esk, the Glass House Mountains and the Mount Flinders areas are of nearly equal importance. Consequently the analysis of the soda trachyte from the Main Range was combined equally with each of the three averages derived from (a) the five Esk rocks, (b) the four Glass House Mountains rocks, and (c) the three Mount Flinders rocks.

The above rocks together total approximately one quarter of the extensive development of middle division rocks in the southern and south-eastern portions of the areas.

The Chinghee Creek, Mount Lindsay, Mount Barney, and Springbrook rocks are all very similar and are representative of the southern and south-eastern material.

Consequently the average obtained by taking each of these latter four rocks and the above average in equal proportions is regarded as being approximately representative of the extruded material of the middle division.

The analyses used were those of the rocks numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 19, 21.

TABLE VII.

|  | 1.                      | 2.     | 3.     | 4.            | 5.     | 6.     | 7.   | 8.     | 9.     | 10.  | 11.    | 12.    | 13.                       | 14.    | 15.    | 16.    | 17.    | 18.    |
|--|-------------------------|--------|--------|---------------|--------|--------|--|--------|--------|--|--------|--------|---------------------------|--------|--------|--------|--------|--------|
| SiO <sub>2</sub> ..  | 74.28                   | 74.20  | 72.35  | 74.10         | 72.73  | 73.10  | 72.38  | 72.02  | 71.56  | 69.32                                      | 66.40  | 65.09  | 65.31                     | 64.58  | 62.15  | 60.58  | 60.00  | 61.24  |
| Al <sub>2</sub> O <sub>3</sub> ..                          | 11.27                   | 11.75  | 10.96  | 12.03         | 13.57  | 13.69  | 12.21  | 12.60  | 11.94  | 16.06                                      | 12.03  | 14.43  | 12.08                     | 17.52  | 16.73  | 18.06  | 10.58  | 14.33  |
| Fe <sub>2</sub> O <sub>3</sub> ..                          | 1.93                    | 1.92   | 2.60   | 2.02          | 0.69   | 1.19   | 3.36   | 0.32   | 4.68   | 1.42                                       | 8.23   | 3.21   | 5.12                      | 2.56   | 2.90   | 3.05   | 6.18   | 1.81   |
| FeO ..   | 0.58                    | 1.30   | 1.50   | 0.86          | 1.43   | 1.43   | 0.69   | 3.29   | 0.46   | 0.88                                       | 0.04   | 0.13   | 3.07                      | 0.96   | 3.22   | 1.38   | 4.72   | 0.09   |
| MgO ..   | 0.44                    | 0.30   | 0.17   | 0.64          | 0.42   | 0.43   | 0.17   | 0.55   | 0.32   | 0.06                                       | 0.40   | 0.10   | 0.06                      | 0.22   | 2.70   | 0.23   | 1.97   | 3.45   |
| CaO ..   | 1.15                    | 0.19   | 1.03   | 1.10          | 1.00   | 0.87   | 0.18   | 1.95   | 0.28   | 0.31                                       | 0.02   | 1.18   | 2.50                      | 0.39   | 3.98   | 1.74   | 2.88   | 5.07   |
| Na <sub>2</sub> O ..                                       | 2.74                    | 4.25   | 3.26   | 3.32          | 4.98   | 4.03   | 3.52   | 4.84   | 4.88   | 6.01                                       | 5.26   | 7.26   | 4.91                      | 6.41   | 3.58   | 5.01   | 6.58   | 3.75   |
| K <sub>2</sub> O ..  | 4.77                    | 5.00   | 4.87   | 4.98          | 3.74   | 4.92   | 5.20   | 2.82   | 5.03   | 4.23                                       | 3.26   | 3.24   | 4.72                      | 6.23   | 2.81   | 6.87   | 2.20   | 3.13   |
| H <sub>2</sub> O+ ..                                       | 1.01                    | 0.27   | 3.50   | 0.81          | 0.95   | 0.54   | 0.86   | 0.20   | 0.40   | } 1.09                                     | { 1.85 | { 2.42 | { 0.57                    | 0.30   | 1.06   | 0.90   | 1.65   | 0.28   |
| H <sub>2</sub> O- ..                                       | 0.70                    | 0.06   | 0.35   | 0.34          | 0.50   | ..     | 0.60   | 0.30   | 0.33   |  |        |        |                           |        |        |        |        |        |
| CO <sub>2</sub> ..   | ..                      | 0.01   | ..     | ..            | ..     | ..     | ..   | ..     | ..     | ..   | ..     | ..     | ..                        | 0.08   | 0.04   | ..     | ..     | ..     |
| TiO <sub>2</sub> ..  | 0.25                    | 0.13   | nil    | 0.21          | tr.    | 0.39   | 0.25   | 0.69   | 0.17   | 0.02                                       | 0.82   | 2.50   | 0.40                      | 0.13   | 0.83   | 0.83   | 1.56   | 0.52   |
| P <sub>2</sub> O <sub>5</sub> ..                           | 0.07                    | abs.   | 0.09   | 0.07          | 0.07   | 0.11   | tr.  | 0.11   | tr.    | ..   | 0.23   | ..     | 0.14                      | tr.    | p.n.d. | ..     | 0.44   | 0.51   |
| MnO ..   | 0.02                    | 0.20   | 0.03   | 0.05          | 0.04   | nil    | 0.70   | 0.04   | tr.    | ..   | 0.05   | ..     | 0.11                      | 0.08   | 0.12   | 0.04   | 0.18   | tr.    |
| &c. ..   | ..                      | 0.60a  | ..     | ..            | ..     | ..     | 0.05b  | ..     | 0.1c   | ..   | ..     | ..     | ..                        | 0.40d  | 0.19c  | 0.07f  | ..     | ..     |
| Total ..   | 99.21                   | 100.12 | 100.71 | 100.58        | 100.12 | 100.10 | 100.26   | 99.73  | 100.06 | 100.00                                     | 100.29 | 99.56  | 100.45                    | 99.97  | 100.45 | 99.75  | 99.50  | 100.35 |
| Sp. Grav.  | 2.37                    | 2.62   | 2.39   | 2.50          | 2.43   | 2.38   | 2.47   | 2.61   | 2.71   | ..   | 2.40   | ..     | 2.40                      | 2.62   | 2.61   | ..     | 2.60   | 2.57   |
| SiO <sub>2</sub> ..  | 70.19                   | 74.78  | 74.68  | 74.53         | 73.72  | 73.42  | 73.37  | 72.59  | 72.07  | 70.08                                      | 67.82  | 67.02  | 65.70                     | 65.18  | 62.76  | 61.94  | 61.72  | 61.30  |
| Al <sub>2</sub> O <sub>3</sub> ..                          | 11.56                   | 11.84  | 11.33  | 12.15         | 13.76  | 13.15  | 12.38  | 12.70  | 12.02  | 16.24                                      | 12.29  | 14.85  | 12.15                     | 17.68  | 16.90  | 18.48  | 10.88  | 14.35  |
| Fe <sub>2</sub> O <sub>3</sub> ..                          | 1.98                    | 1.94   | 2.68   | 2.03          | 0.70   | 1.20   | 3.40   | 0.32   | 4.71   | 1.44                                       | 8.40   | 3.30   | 5.15                      | 2.59   | 2.93   | 3.12   | 6.35   | 1.81   |
| FeO ..   | 0.59                    | 1.31   | 1.55   | 0.66          | 1.45   | 1.44   | 0.70   | 3.31   | 0.46   | 0.89                                       | 0.05   | 0.13   | 3.09                      | 0.97   | 3.25   | 1.40   | 4.86   | 6.10   |
| MgO ..   | 0.45                    | 0.30   | 0.17   | 0.64          | 0.42   | 0.43   | 0.17   | 0.55   | 0.32   | 0.06                                       | 0.41   | 0.10   | 0.07                      | 0.22   | 2.73   | 0.23   | 2.02   | 3.45   |
| CaO ..   | 1.18                    | 0.19   | 1.06   | 1.11          | 1.01   | 0.87   | 0.18   | 1.97   | 0.28   | 0.31                                       | 0.03   | 1.21   | 2.52                      | 0.39   | 4.02   | 1.78   | 2.96   | 5.08   |
| Na <sub>2</sub> O ..                                       | 2.81                    | 4.28   | 3.37   | 3.34          | 5.04   | 4.05   | 3.57   | 4.88   | 4.91   | 6.08                                       | 5.36   | 7.47   | 4.94                      | 6.47   | 3.61   | 5.13   | 6.75   | 3.75   |
| K <sub>2</sub> O ..  | 4.89                    | 5.03   | 5.04   | 5.01          | 3.79   | 4.94   | 5.27   | 2.84   | 5.06   | 4.28                                       | 3.32   | 3.34   | 4.74                      | 6.20   | 2.84   | 7.03   | 2.20   | 3.13   |
| TiO <sub>2</sub> ..  | 0.26                    | 0.13   | nil    | 0.21          | ..     | 0.39   | 0.25   | 0.69   | 0.17   | 0.02                                       | 0.84   | 2.58   | 0.49                      | 0.13   | 0.84   | 0.85   | 1.58   | 0.52   |
| P <sub>2</sub> O <sub>5</sub> ..                           | 0.07                    | abs.   | 0.09   | 0.07          | 0.07   | 0.11   | tr.  | 0.11   | tr.    | ..   | 0.23   | ..     | 0.14                      | tr.    | p.n.d. | ..     | 0.44   | 0.51   |
| MnO ..   | 0.02                    | 0.20   | 0.03   | 0.05          | 0.04   | nil    | 0.70   | 0.04   | tr.    | ..   | 0.05   | ..     | 0.11                      | 0.08   | 0.12   | 0.04   | 0.18   | tr.    |
| Total ..   | 100.00                  | 100.00 | 100.00 | 100.00        | 100.00 | 100.00 | 100.00   | 100.00 | 100.00 | 100.00                                     | 100.60 | 100.00 | 100.00                    | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| (a) NIO 0.03<br>ZrO <sub>2</sub> 0.38<br>F 0.02<br>Cl 0.17 | (b) NIO 0.04<br>Cl 0.01 |        |        | -(c) NIO 0.01 |        |        | (d) ZrO <sub>2</sub> 0.21<br>NIO 0.03<br>Cl 0.08<br>S (FeS <sub>2</sub> ) 0.08 |        |        | (e) NIO 0.08<br>S (FeS <sub>2</sub> ) 0.11 |        |        | (f) NIO } 0.07<br>(FeO) } |        |        |        |        |        |

BY H. C. RICHARDS.

TABLE VII.—continued.

| —                                    | 19.    | 20.    | 21.    | 22.    | 23.    | 24.    | 25.    | 26.    | 27.    | 28.    | 29.    | 30.    | 31.    | 32.    | 33.    | 34.    | 35.    |
|--------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SiO <sub>2</sub> .. ..               | 56.52  | 57.02  | 56.78  | 52.95  | 54.10  | 52.24  | 51.80  | 51.69  | 51.80  | 50.78  | 50.24  | 49.90  | 50.27  | 49.32  | 48.96  | 48.55  | 47.50  |
| Al <sub>2</sub> O <sub>3</sub> .. .. | 17.55  | 13.63  | 14.47  | 15.50  | 13.42  | 16.52  | 16.03  | 13.16  | 18.56  | 15.16  | 16.59  | 15.79  | 12.56  | 18.11  | 16.58  | 12.45  | 14.19  |
| Fe <sub>2</sub> O <sub>3</sub> .. .. | 3.14   | 5.41   | 2.80   | 2.62   | 4.06   | 4.52   | 2.72   | 3.90   | 0.38   | 2.36   | 2.72   | 4.52   | 2.44   | 2.51   | 1.95   | 3.00   | 1.78   |
| FeO .. ..                            | 4.86   | 5.15   | 6.05   | 7.29   | 7.43   | 6.61   | 7.91   | 8.65   | 10.09  | 10.01  | 8.35   | 6.25   | 8.18   | 4.86   | 8.62   | 10.43  | 12.15  |
| MgO .. ..                            | 2.51   | 2.86   | 0.34   | 2.89   | 4.43   | 3.55   | 5.34   | 6.84   | 3.72   | 1.43   | 5.14   | 5.77   | 10.25  | 8.05   | 7.97   | 7.61   | 5.06   |
| CaO .. ..                            | 5.50   | 5.57   | 2.47   | 4.92   | 7.07   | 8.20   | 8.38   | 8.41   | 5.77   | 6.46   | 8.70   | 9.12   | 7.52   | 8.90   | 8.75   | 7.58   | 7.47   |
| Na <sub>2</sub> O .. ..              | 4.82   | 3.38   | 8.67   | 4.46   | 3.81   | 3.28   | 3.89   | 2.76   | 3.36   | 3.54   | 3.54   | 3.24   | 3.29   | 1.90   | 3.08   | 3.20   | 3.85   |
| K <sub>2</sub> O .. ..               | 1.90   | 3.07   | 4.51   | 2.94   | 1.15   | 1.48   | 0.29   | 0.45   | 2.10   | 2.20   | 0.40   | 0.89   | 1.42   | 3.30   | 0.91   | 1.75   | 1.58   |
| H <sub>2</sub> O+ .. ..              | 2.45   | 1.54   | 1.70   | 2.18   | 0.88   | 0.65   | 0.88   | 1.00   | 0.56   | 1.32   | 1.84   | 1.36   | 1.14   | 1.80   | 1.18   | 1.66   | 1.59   |
| H <sub>2</sub> O- .. ..              | 0.25   | nil    | 0.56   | 0.75   | nil    | 0.58   | 1.10   | 0.55   | 0.24   | 0.75   | 1.02   | 1.28   | 0.46   | 0.28   | 0.66   | 0.34   | 0.33   |
| CO <sub>2</sub> .. ..                | ..     | ..     | ..     | ..     | ..     | ..     | ..     | ..     | ..     | 0.01   | ..     | ..     | ..     | ..     | ..     | ..     | ..     |
| TiO <sub>2</sub> .. ..               | tr.    | 1.75   | 2.00   | 1.84   | 2.35   | 1.44   | 0.82   | 1.70   | 0.70   | 2.60   | 0.72   | 1.98   | 2.26   | 0.60   | 0.81   | 1.34   | 3.08   |
| P <sub>2</sub> O <sub>5</sub> .. ..  | 0.22   | 0.40   | ..     | 1.15   | 0.46   | 0.80   | 0.26   | 0.28   | 1.44   | 0.34   | 0.41   | 0.43   | 0.60   | 0.27   | 0.34   | 0.61   | 0.70   |
| MnO .. ..                            | 0.13   | 0.26   | tr.    | 0.14   | 0.30   | tr.    | 0.23   | 0.14   | 0.18   | 0.14   | 0.29   | 0.12   | 0.18   | 0.47   | 0.14   | 0.25   | 0.20   |
| &c. .. ..                            | ..     | ..     | 0.059  | ..     | ..     | ..     | ..     | ..     | ..     | 0.30h  | ..     | ..     | ..     | ..     | ..     | ..     | ..     |
| Total .. ..                          | 99.85  | 100.64 | 100.40 | 99.69  | 100.36 | 99.87  | 100.25 | 99.62  | 99.50  | 100.40 | 99.96  | 100.65 | 100.51 | 100.37 | 99.95  | 99.40  | 99.57  |
| Sp. Grav. ..                         | 2.75   | 2.64   | ..     | 2.74   | 2.79   | 2.87   | ..     | 2.92   | ..     | ..     | 2.81   | 2.76   | 2.88   | 2.89   | 2.87   | ..     | 2.79   |
| SiO <sub>2</sub> .. ..               | 58.15  | 58.15  | 57.88  | 54.72  | 54.38  | 52.96  | 52.73  | 52.69  | 52.55  | 51.81  | 51.72  | 53.02  | 50.83  | 50.20  | 49.91  | 49.87  | 48.58  |
| Al <sub>2</sub> O <sub>3</sub> .. .. | 18.09  | 13.75  | 14.77  | 16.09  | 13.50  | 16.74  | 16.92  | 13.45  | 18.82  | 15.47  | 17.07  | 16.12  | 12.65  | 18.43  | 16.89  | 12.79  | 14.55  |
| Fe <sub>2</sub> O <sub>3</sub> .. .. | 3.23   | 5.46   | 2.86   | 2.70   | 4.08   | 4.60   | 2.77   | 4.07   | 0.38   | 2.41   | 2.81   | 4.61   | 2.46   | 2.55   | 1.99   | 3.09   | 1.83   |
| FeO .. ..                            | 5.01   | 5.20   | 6.17   | 7.53   | 7.47   | 6.71   | 8.05   | 8.81   | 10.83  | 10.22  | 8.59   | 6.37   | 8.27   | 4.94   | 8.78   | 10.71  | 12.46  |
| MgO .. ..                            | 2.58   | 2.89   | 0.34   | 3.00   | 4.45   | 3.59   | 5.42   | 6.98   | 3.76   | 1.52   | 5.30   | 5.89   | 10.36  | 8.19   | 8.13   | 7.84   | 5.19   |
| CaO .. ..                            | 5.66   | 5.62   | 2.51   | 5.09   | 8.01   | 8.31   | 8.52   | 8.57   | 5.84   | 6.59   | 8.07   | 9.30   | 7.60   | 9.05   | 8.92   | 7.78   | 7.66   |
| Na <sub>2</sub> O .. ..              | 4.97   | 3.41   | 8.83   | 4.60   | 3.83   | 3.34   | 3.96   | 2.81   | 3.34   | 3.65   | 3.65   | 3.30   | 3.32   | 1.93   | 3.14   | 3.28   | 3.95   |
| K <sub>2</sub> O .. ..               | 1.96   | 3.10   | 4.60   | 3.05   | 1.16   | 1.50   | 0.30   | 0.46   | 2.13   | 2.24   | 0.41   | 0.91   | 1.44   | 3.35   | 0.93   | 1.80   | 1.62   |
| TiO <sub>2</sub> .. ..               | tr.    | 1.76   | 2.04   | 1.90   | 2.36   | 1.46   | 0.84   | 1.74   | 0.71   | 2.65   | 0.75   | 2.02   | 2.28   | 0.61   | 0.83   | 1.37   | 3.15   |
| P <sub>2</sub> O <sub>5</sub> .. ..  | 0.22   | 0.40   | ..     | 1.18   | 0.46   | 0.81   | 0.26   | 0.28   | 1.46   | 0.34   | 0.43   | 0.44   | 0.61   | 0.27   | 0.34   | 0.62   | 0.81   |
| MnO .. ..                            | 0.13   | 0.26   | tr.    | 0.14   | 0.30   | tr.    | 0.23   | 0.14   | 0.18   | 0.14   | 0.30   | 0.12   | 0.18   | 0.48   | 0.14   | 0.25   | 0.20   |
| Total .. ..                          | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

(g) NiO 0.05.

(h) SO<sub>3</sub> 0.15; Cl 0.02, NiO.CoO 0.05, BaO 0.05, V<sub>2</sub>O<sub>5</sub> 0.02; CuO 0.01.

1. Rhyolite—3½ miles south of Lamington, por. 58v, par. Telemon.
2. Comendite—Mount Conowrin, Glass House Mountains.
3. Pitchstone—Mount Lindsay.
4. Rhyolite—Mount Barney.
5. Rhyolite—Glen Rock, Esk.
6. Rhyolite—Springbrook Plateau, por. 89, par. Numinbah.
7. Pantellerite—Mount Ngun-Ngun, Glass House Mountains.
8. Rhyolite—Ottaba, por. 28v, par. Biarra, Esk District.
9. Pantellerite—Trachyte Range, Glass House Mountains.
10. Porphyritic Soda-Trachyte—Mount Flinders.
11. Trachyte—Portion 130A, par. Esk.
12. Soda-Trachyte—2,000 feet level, Warwick coach road, Main Range.
13. Trachyte—Cainbale Creek, por. 12, par. Numinbah.
14. Trachyte—Mount Beerwah, Glass House Mountains.
15. Dacite—Near Bankfoot House, Glass House Mountains.
16. Trachyte—Summit, Mount Flinders.
17. Trachyte—Portion 51, par. Esk.
18. Andesite—Observation Hill, Tweed Heads.
19. Augite-Andesite—Portion 134, par. Esk.
20. Andesite—Tamborine Plateau, por. 18, par. Witherin.
21. Phonolitic-Aegirine-Trachyte—Foot of Mount Flinders.
22. Oligoclase-Basalt—Summit of Spicer's Peak.
23. Andesite—Springbrook Plateau, por. 84, par. Numinbah.
24. Andesitic-Basalt—Burleigh Heads.
25. Basalt—South of Ipswich, por. 25/26, par. Purga.
26. Basalt—Quarries, Bundamba.
27. Basalt—South of Ipswich, por. 124, par. Purga.
28. Olivine-Basalt—Fingal Point, Tweed Heads.
29. Basalt—Walkden's Quarry, Cooper's Plains.
30. Basalt—Two miles south of Lamington, por. 69, par. Telemon.
31. Basalt—Quarries, Toowoomba.
32. Basalt—Red Hill, Ipswich.
33. Basalt—Four miles south of Lamington, por. 67v, par. Telemon.
34. Basalt—Pittsworth, Queensland.
35. Basalt—3,000 feet level, south-east side, Mount Lindsay.

*Average Composition of the Volcanic Rocks of the  
Lower Division.*

This is of much less importance than the other two divisions and two analyses only were used here. They were combined equally in making the determination, and the analyses used were those of rocks numbered 30, 35.

*Mean Average Composition of the Volcanic Rocks  
of the Area.*

All three divisions are represented in each of the important accumulations of extruded material, and the average thicknesses are 1,000, 500 and 100 feet respectively for the upper, middle and lower divisions.

The actual areal distribution of each division is approximately the same, as they are all piled one on top of the other, so that a general ratio of 10 : 5 : 1 is arrived at for the respective volumes of the upper, middle and lower divisions.

By combining the averages for each of these divisions of rocks in these proportions, the following average composition as shown in Table VIII. of the whole of the volcanic rocks of the area is obtained. For the purposes of these calculations, all the rocks were assumed to have the same density, as the roughness of the mapping did not warrant one taking differences of density into account. The average analysis is seen to be close to the average andesite given by Daly,<sup>45</sup> and also to the andesite from the southern end of Tamborine Plateau. It differs from the average andesite analysis mainly in alumina and iron-oxide value, though on totalling these a close approximation is obtained. The magnesia is rather higher, the lime slightly lower, and the potash a little higher than in the average andesite analysis.

In comparing the average obtained with the Tamborine andesite it is seen that the former is about 1 per cent. higher in silica, the ferric oxide is considerably lower, the magnesia is rather higher, and the potash and also the titania a little lower.

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<sup>45</sup> Igneous Rocks and their Origin, p. 26.

This estimated average composition for the whole of the volcanic rocks of the area is based on rough general calculations, but it may be regarded as approximately correct.

TABLE VIII.—AVERAGE COMPOSITIONS.

| . —                               | I.     | II.    | III.   | IV.    | V.     | VI.    |
|-----------------------------------|--------|--------|--------|--------|--------|--------|
| SiO <sub>2</sub> ..               | 52.45  | 71.73  | 48.63  | 58.24  | 59.59  | 57.25  |
| Al <sub>2</sub> O <sub>3</sub> .. | 15.05  | 12.30  | 14.97  | 14.19  | 17.31  | 13.54  |
| Fe <sub>2</sub> O <sub>3</sub> .. | 2.80   | 2.16   | 3.14   | 2.62   | 3.33   | 5.38   |
| FeO ..                            | 7.89   | 1.21   | 9.19   | 5.89   | 3.13   | 5.12   |
| MgO ..                            | 5.48   | 0.42   | 5.41   | 3.89   | 2.75   | 2.84   |
| CaO ..                            | 7.32   | 1.09   | 8.28   | 5.43   | 5.80   | 5.53   |
| Na <sub>2</sub> O ..              | 3.38   | 3.85   | 3.53   | 3.54   | 3.58   | 3.36   |
| K <sub>2</sub> O ..               | 1.76   | 4.74   | 1.23   | 2.66   | 2.04   | 3.05   |
| H <sub>2</sub> O+ ..              | 1.21   | 1.55   | 1.47   | 1.33   | 1.26   | 1.53   |
| H <sub>2</sub> O- ..              | 0.49   | 0.42   | 0.86   | 0.49   |        |        |
| TiO <sub>2</sub> ..               | 1.40   | 0.40   | 2.52   | 1.16   | 0.77   | 1.74   |
| P <sub>2</sub> O <sub>5</sub> ..  | 0.56   | 0.09   | 0.61   | 0.42   | 0.26   | 0.40   |
| MnO ..                            | 0.19   | 0.04   | 0.16   | 0.14   | 0.18   | 0.26   |
| Total ..                          | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

*Calculated as Water-Free.*

|                                   |        |        |        |        |        |        |
|-----------------------------------|--------|--------|--------|--------|--------|--------|
| SiO <sub>2</sub> ..               | 53.37  | 73.17  | 49.88  | 59.34  | 60.35  | 58.15  |
| Al <sub>2</sub> O <sub>3</sub> .. | 15.31  | 12.58  | 15.32  | 14.46  | 17.54  | 13.75  |
| Fe <sub>2</sub> O <sub>3</sub> .. | 2.85   | 2.20   | 3.22   | 2.67   | 3.37   | 5.46   |
| FeO ..                            | 8.03   | 1.23   | 9.31   | 5.99   | 3.17   | 5.20   |
| MgO ..                            | 5.58   | 0.43   | 5.53   | 3.97   | 2.78   | 2.89   |
| CaO ..                            | 7.44   | 1.11   | 8.47   | 5.53   | 5.87   | 5.62   |
| Na <sub>2</sub> O ..              | 3.43   | 3.93   | 3.61   | 3.59   | 3.63   | 3.41   |
| K <sub>2</sub> O ..               | 1.80   | 4.82   | 1.25   | 2.71   | 2.07   | 3.10   |
| TiO <sub>2</sub> ..               | 1.43   | 0.40   | 2.63   | 1.18   | 0.78   | 1.76   |
| P <sub>2</sub> O <sub>5</sub> ..  | 0.57   | 0.09   | 0.62   | 0.42   | 0.26   | 0.40   |
| MnO ..                            | 0.19   | 0.04   | 0.16   | 0.14   | 0.18   | 0.26   |
| Total ..                          | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

I.—Average composition of Volcanic Rocks of Upper Division.

II.—Average composition of Volcanic Rocks of Middle Division.

III.—Average composition of Volcanic Rocks of Lower Division.

IV.—Average composition of Volcanic Rocks of all three Divisions.

V.—Average composition of 87 Andesites. (a)

VI.—Composition of Andesite from Tamborine Plateau, par. 18, parish Witherin.

(a) Daly. Igneous Rocks.

All the analyses available were used with the exception of that of the Glass House Mountains dacite and the Cainbale Creek trachyte. These are both of very minor importance, and would not really affect the determinations carried out above.

### *Magmatic Relationships.*

In order to see whether the volcanic rocks were magmatically related, the recalculated analyses, in percentages by weight, were plotted with the different oxides against the silica in the usual way in the constitution of variation diagrams. It is quite obvious that the rocks as a whole do not conform to one particular curve for each oxide, and investigation shows that it is necessary to have at least three curves. The rocks which are definitely alkaline conform closely to one series of curves having all the characteristics of curves for alkaline rocks, while the rocks definitely sub-alkaline conform closely to one series of curves which have all the characteristics of curves for sub-alkaline rocks. There are, however, nine rocks whose somewhat intermediate character had been detected already microscopically, and these are all found to conform fairly well with a series of curves which take up, as a rule, an intermediate position between the alkaline and sub-alkaline curves.

An examination of all the diagrams (*see* Plates VI.-IX.) shows that generally speaking there is a close conformity of the three series of rocks to their respective curves in each diagram.

While in general the term "alkaline" as applied to rocks may be satisfactory the author felt that he wanted some specific information for the correct determination of the character of certain rocks, particularly the acid ones.

A fine series of generalised variation diagrams which Harker shows on pages 150 and 151 of "The Natural History of Igneous Rocks" proved of very great value in this direction and the author adapted them for the purpose mentioned above. By drawing up the variation diagrams, each with its three curves, and also plotting Harker's adapted generalised variation diagrams showing the curves for the alkaline (atlantic) and sub-alkaline (pacific) series,

the normality or otherwise of the alkaline and sub-alkaline series of the rocks in question is shown, also the intermediate nature of the third series is made quite evident.

There is no question as to the reliability of the curves on Harker's generalised variation diagrams, and they furnish an excellent method of comparison. Harker's curves are plotted from analyses of all igneous rocks whereas we are concerned with volcanic rocks only, and although in certain minor respects the curves for volcanic rocks would differ from curves for plutonic rocks, the influence this would have on these comparisons might be considered of minor importance. In addition Harker's curves have not been drawn up from water-free analyses recalculated to 100 per cent

There are many interesting features about the variation diagrams but the most outstanding thing is the general paucity of alumina and the general richness of iron-oxides for the rocks as a whole. Curves have been drawn for lime, magnesia, soda, potash, combined soda and potash, alumina, total iron-oxides as ferrous oxide, and combined alumina and total ferrous oxide. Well-shaped curves with the respective rocks of each series closely conforming to its particular curve can be drawn for lime, magnesia, soda, potash, combined soda and potash, and combined alumina and total iron-oxide as ferrous oxide.

In the case of alumina alone, and also of the total iron-oxides as ferrous oxide, it is impossible to draw curves of any value at all which have all the rocks conforming to them; but it is most noticeable that by combining these two values and plotting them, excellent curves, with the rocks closely conforming, can be drawn. An examination of Plate VIII. shows that the alumina values are as a rule markedly low and the ferrous oxide values markedly high, and, moreover, there is an antipathetic variation from the normal curve of these values in the same rock. Normally, curves for alumina and ferrous oxides are antipathetic, so that one might expect to obtain reasonable curves for the combined oxides. This expectation is very well fulfilled (see Plate IX.), and the curves for the three rock series are all very close and are closely comparable with the

curves for these combined oxides which have been adapted from Harker's curves. The only rock that does not conform well is the Toowoomba basalt, and the low alumina value is accompanied by a high magnesia value; this rock is extremely rich in olivine.

Thus while the alumina is certainly low and the total iron-oxides as ferrous oxide certainly high, the combined oxides are thoroughly normal.

The curves for lime are all good ones, and when compared with the generalised curves of Harker it is seen that both the sub-alkaline and alkaline series are slightly lower than normal, while the third series occupies an intermediate position.

The curves for magnesia are, generally speaking, good, although the Burleigh Heads andesitic-basalt has a low value, and the Toowoomba basalt a high value. The Burleigh Heads rock in other respects is, however, nearly normal. The Toowoomba basalt is extremely rich in olivine, and this accounts for the high value for magnesia, and it is to be noted that the alumina value for this rock is correspondingly low. The curve for the sub-alkaline series is almost normal although a little low, but that for the alkaline series is considerably lower than the normal alkaline curve. The third series gives a very good curve which takes up an intermediate position between the other two.

The curves for soda are reasonably good, but in comparison with the generalised curves of Harker the alkaline curve is seen to be considerably higher, and the sub-alkaline curve, while nearly normal, is a shade high towards the basic end. The curve for the third series is again in an intermediate position. The trachyte from the summit of Mount Flinders is considerably below the alkaline curve, but in the potash diagram it is seen to be somewhat above. The rocks as a whole are a little above the normal in soda.

The curves for potash are not as good as those for soda, and show the alkaline series to be slightly above the normal, and the sub-alkaline series rather more so, except towards the basic end. The rhyolite from Glen Rock is considerably off the curve for the third series. The rocks as a whole are a little above the normal in their potash value.

The curves for combined soda and potash are good curves, and both the alkaline and sub-alkaline curves are somewhat above the normal. The trachyte from Cainbale Creek, which on general considerations is regarded as belonging to the sub-alkaline series, is rather richer in alkalis than the others of that series. The third series of rocks again takes up an intermediate position. Curves for phosphorus pentoxide, titania and manganese oxide have not been drawn up.

After an investigation of these variation diagrams, it is clear that the rocks of the area belong to three series, an alkaline series, a sub-alkaline series, and a third series intermediate between these two, also that the rocks of the area as a whole are a little higher in both soda and potash, and a little lower in both lime and magnesia, than the normal, and although the alumina is low and the total iron-oxides are high, the combined oxides of aluminium and iron are normal.

#### *The Alkaline Series.*

The rocks of this series are from the Glass House Mountains, Flinders Range and the Main Range. There are eight analyses, and all are those of Dr. Jensen. These rocks form perhaps 5 per cent. of the volcanic rocks of this area, which has been generally regarded as one rich in alkaline eruptives.

The series ranges from acid to sub-acid and is much more restricted in that respect than the other series. It is particularly rich in alkalies and rather deficient in lime and magnesia, when compared with the alkaline rocks as a whole; but this is to be expected to some extent as alkaline volcanic extrusives are, in general, more salic than the equivalent plutonic types.

The occurrences are somewhat scattered and separated from one another. Dr. Jensen has dwelt on the fact that these alkaline rocks have been poured out near the junctions of the Palæozoic and Mesozoic formations. This is in general true, but we have had apparently similar conditions of folding, faulting and position with regard to Mesozoic coastlines &c., for both the alkaline and sub-alkaline series.

Dr. Jensen<sup>46</sup> has also advocated the assimilation of carbonate rocks by the parent magma with the resultant production of alkaline material. Daly<sup>47</sup> has elaborated this view, and indicates that, in the localities with which we are here concerned, highly calcareous Mesozoic sediments and possibly Palæozoic limestones have been cut by the alkaline eruptives. While small lenticular patches of limestone a few feet in diameter, and sandstone beds containing abundant calcareous material, are occasionally met in the Mesozoic sediments of this area, the use of the term "highly calcareous" does not seem at all justified for the formation as a whole; and, as far as the author can learn, there is no justification at all for assuming that Palæozoic limestones have been cut through, for the Mesozoic sediments lie unconformably on the old Palæozoic schists which are not at all specially calcareous but rather the reverse and which are older than any known deposit of limestone in this portion of Queensland. An analysis of a typical sample of these schists by the Agricultural Chemist, Brisbane, gave 1.59 per cent. CaO, 3.39 per cent. Na<sub>2</sub>O, 3.07 per cent. K<sub>2</sub>O.

As far as this area is concerned the evidence is rather against any special limestone assimilation by the sub-alkaline magma.

Daly apparently holds that the sub-alkaline magma as it traverses the formation absorbs the limestone or dolomite with the resultant production of alkaline material. The thickness of Mesozoic formations traversed by the alkaline rocks in the Glass House Mountains and Mount Flinders area is really small, especially at Mount Beerwah, and it seems inconceivable to the author that the alkaline nature of this material resulted subsequently to the passage of the material into the Mesozoic material. If it did so, then one is faced with explaining why one finds alkaline lavas and sub-alkaline lavas resting one on top of the other and poured out in all probability from the same opening.

At the Main Range, we have alkaline trachyte occurring between sub-alkaline, sub-basic, and basic lavas.

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<sup>46</sup> Proc. Linn. Soc., N.S.W., 1908, vol. xxxiii.

<sup>47</sup> Op. cit.

It is very difficult to fit in the above evidence with the idea that the alkaline magma results from the assimilation of limestone material as the Palæozoic and Mesozoic formations are intruded. It is conceivable that, in the magma reservoir, the absorption of limestone material would bring about a magmatic splitting resulting in an alkaline partial magma being formed, but it has already been shown that the sub-alkaline as well as the alkaline rocks are really slightly deficient in lime and magnesia.

It is of interest also to note that in connection with Daly's theory Professor P. Marshall states<sup>45</sup>:—"There appears to be no evidence in support of this theory as far as our knowledge of the alkaline rocks of the South Pacific Islands allows us to form a judgment at the present time."

The evidence from this area is certainly strongly in favour of differentiation of the original magma resulting in the formation of the alkaline material having taken place in the magma reservoir. The average composition of the alkaline rocks in the area has been estimated, and the Glass House Mountains area, Mount Flinders area, and the Main Range area were assumed to be of approximately equal importance in making the calculation.

The result is possibly a little high in soda and titania, as the Main Range trachyte was especially rich in these two, and perhaps more so than usual. Analyses used were those of rocks numbered 2, 7, 9, 10, 12, 14, 16, 21.

### *Sub-alkaline Series.*

This series of rocks is represented in the upper, middle, and lower divisions, and embraces something more than 90 per cent. of the extruded material. The series ranges from acid to basic, and the rocks occur in all parts of the area. In comparison with normal sub-alkaline rocks, it has been shown that this series is characterised by a slightly higher alkali percentage and slightly lower lime and magnesia percentage; also, while the alumina is lower and the iron-oxides higher, the combination of these is about normal.

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<sup>45</sup> Trans. and Proc., N. Z. Inst., vol. xlvii., 1915, p. 372.

There is little doubt as to the magmatic relationship of the rocks of this series, for in practically all the curves all the rocks conform closely.

Considering the extent of the area from which these rocks have been collected, and the fact that at least four different analysts carried out the chemical work, the general conformity to the curves might be considered good. The magmatic relationship existing between acid and basic rocks in this series is of note, because the alkaline series seems restricted to acid and sub-acid representatives.

The mean average composition of the sub-alkaline series has been determined, and in doing so the results of the eighteen analyses of the series were combined equally, for it was considered that the rocks analysed in the general way represented the rocks of the series in the proper proportions. Analyses used were those of rocks numbered 1, 3, 4, 6, 13, 15, 18, 20, 23, 24, 25, 26, 29, 30, 31, 32, 33, 34.

#### *Intermediate Series.*

This series embraces rocks from the upper, middle, and lower divisions, and their positions in these divisions are worthy of note. The basalt from Mount Lindsay is the uppermost flow of the lower division, and the basalts from the summit of Mount Spicer, Purga, and Fingal Point, Tweed Heads, are some of the most recent flows of the upper division, while the five remaining rocks of the series from the Esk district are believed to belong to the middle division. Whether the occurrence of these rocks at the termination of two periods of activity during which basic rocks have been poured out is a mere coincidence or not, is a question. It is true that following upon the Mount Lindsay basalt there were acid rocks made up almost entirely of quartz and alkali felspar, but whether this has any bearing or not on the somewhat intermediate character of this basalt is at present indefinite.

One may explain this series of rocks as resulting from a magma formed by an admixture of the alkaline and sub-alkaline magmas, or else from a separate partial magma which had been split off from the parent magma in the same way that one assumes other partial magmas to have

resulted. This series is, perhaps, more closely allied to the sub-alkaline series than to the alkaline series. An estimate of the average composition of this series has been made, and in doing so the nine rocks analysed were taken as equally proportionate. Analyses used were those of rocks numbered 5, 8, 11, 17, 19, 22, 27, 28, 35.

TABLE IX.—AVERAGE COMPOSITIONS.

| —                              |    |    |    |    | I.     | II.    | III.   |
|--------------------------------|----|----|----|----|--------|--------|--------|
| SiO <sub>2</sub>               | .. | .. | .. | .. | 66.13  | 58.24  | 59.06  |
| Al <sub>2</sub> O <sub>3</sub> | .. | .. | .. | .. | 14.69  | 14.07  | 14.41  |
| Fe <sub>2</sub> O <sub>3</sub> | .. | .. | .. | .. | 2.93   | 3.00   | 2.83   |
| FeO                            | .. | .. | .. | .. | 1.25   | 5.51   | 6.13   |
| MgO                            | .. | .. | .. | .. | 0.19   | 4.26   | 2.45   |
| CaO                            | .. | .. | .. | .. | 0.98   | 5.83   | 4.07   |
| Na <sub>2</sub> O              | .. | .. | .. | .. | 6.22   | 3.38   | 4.64   |
| K <sub>2</sub> O               | .. | .. | .. | .. | 4.61   | 2.52   | 2.54   |
| H <sub>2</sub> O+              | .. | .. | .. | .. | 0.98   | 1.21   | 1.42   |
| H <sub>2</sub> O—              | .. | .. | .. | .. | 0.66   | 0.47   | 0.47   |
| TiO <sub>2</sub>               | .. | .. | .. | .. | 1.27   | 1.03   | 1.30   |
| P <sub>2</sub> O <sub>5</sub>  | .. | .. | .. | .. | tr.    | 0.33   | 0.53   |
| MnO                            | .. | .. | .. | .. | 0.09   | 0.15   | 0.12   |
| Total                          | .. | .. | .. | .. | 100.00 | 100.00 | 100.00 |

*Calculated as Water-Free.*

|                                |    |    |    |    |        |        |        |
|--------------------------------|----|----|----|----|--------|--------|--------|
| SiO <sub>2</sub>               | .. | .. | .. | .. | 67.23  | 59.25  | 60.19  |
| Al <sub>2</sub> O <sub>3</sub> | .. | .. | .. | .. | 14.95  | 14.29  | 14.73  |
| Fe <sub>2</sub> O <sub>3</sub> | .. | .. | .. | .. | 2.98   | 3.05   | 2.89   |
| FeO                            | .. | .. | .. | .. | 1.27   | 5.61   | 6.25   |
| MgO                            | .. | .. | .. | .. | 0.19   | 4.33   | 2.49   |
| CaO                            | .. | .. | .. | .. | 1.00   | 5.94   | 4.15   |
| Na <sub>2</sub> O              | .. | .. | .. | .. | 6.32   | 3.43   | 4.73   |
| K <sub>2</sub> O               | .. | .. | .. | .. | 4.68   | 2.56   | 2.59   |
| TiO <sub>2</sub>               | .. | .. | .. | .. | 1.29   | 1.05   | 1.32   |
| P <sub>2</sub> O <sub>5</sub>  | .. | .. | .. | .. | tr.    | 0.34   | 0.54   |
| MnO                            | .. | .. | .. | .. | 0.09   | 0.15   | 0.12   |
| Total                          | .. | .. | .. | .. | 100.00 | 100.00 | 100.00 |

I.—Average Composition of Alkaline Series of Volcanic Rocks.

II.—Average Composition of Sub-alkaline Series of Volcanic Rocks.

III.—Average Composition of Series intermediate between Alkaline and Sub-alkaline.

## VII. PETROGRAPHIC PROVINCES.

The conclusions to be derived from the above considerations are—

1. During the ? Lower Cainozoic period there was an extensive basic to sub-basic sub-alkaline province over most of the southern and western portion of the area.
2. During the ? Middle Cainozoic period there was an acid sub-alkaline sub-province, and at least three acid to sub-acid alkaline sub-provinces, two of which, namely, those of the Main Range and Mount Flinders, were probably connected.
3. During the ? Upper Cainozoic period there was a basic to sub-basic sub-alkaline province over almost the whole area.

In addition to this, during the ? Middle Cainozoic period, there was a sub-province in the Esk district, particularly characterised by an acid to sub-acid series of rocks of a nature intermediate between the alkaline and sub-alkaline but more allied perhaps to the latter.

*Relationship between the Volcanic Rocks and Earth  
Movements.*

There is no evidence in this area of the folding movements such as Harker<sup>49</sup> associates with the pacific or sub-alkaline type of rocks; but, on the other hand, faulting on an extensive scale is known to have taken place along certain lines. The main fault-lines are in a general north and south direction along the eastern escarpment of the Main Range, and along a line to the west of Ipswich; there is a possible extension of this latter fault-line in a north-east and south-west direction to Mount Flinders.

The Main Range faulting took place at some time subsequent to the extrusion of the volcanic rocks of the upper division, as they had been dissected by streams to a depth of 1500 feet at least, but whether faulting had occurred

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<sup>49</sup> Natural History of Igneous Rocks.

along this line before, it is difficult to say. However, we have along this particular line both the upper and lower sub-alkaline extrusions with the alkaline extrusions between, so that it is difficult to see how Harker's generalisations hold here. The available evidence certainly does not support the generalisations made by Harker. Similar conclusions have been arrived at for the Victorian Cainozoic rocks by Professor Skeats and Dr. Summers.<sup>50</sup>

In all probability, further evidence of faulting will be forthcoming in the southern portion of the area, but there is nothing to suggest that folding except on a very minor scale has happened anywhere in the area since the Palaeozoic era.

### VIII. ORIGIN OF THE VOLCANIC ROCKS.

It has been shown that different portions and also in some cases the same portions of the area have been characterised by different series of volcanic rocks at various times. This one assumes to be the result of magmatic differences, and further that these different magmas have been derived from the parent magma. Certain characteristics which are common to the different series strengthen the belief that they are magmatically related. These characteristics have been frequently cited earlier, and are the general paucity in alumina and corresponding richness in iron-oxides, together with a slight lack of lime and magnesia and a slight excess of the alkalis.

An estimate of the general composition of this parent magma has been made, and it is very close to that of the average andesite.

That such a rock magma could exist is shown by the similarity of its composition with that of the andesite from the southern portion of Tamborine Plateau.

The parent magma split up in some way into a large sub-alkaline magma, and several smaller alkaline magmas, and magmas with a composition intermediate between the

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<sup>50</sup> Geol. Surv., Victoria, Bull. 24; and Proc. Roy. Soc., Vic., 1914, p. 289.

sub-alkaline and alkaline ones. Serial differentiation then went on in these magmas, and as a result the various rocks were separated out.

With the sub-alkaline magma, the order of separation and extrusion of the material seems to have been as follows:—Basic, then sub-basic and basic, extensive acid, still more extensive basic and sub-basic, and finally basic. While the sub-alkaline magma was extruding the acid material the alkali magmas were sending off acid and sub-acid material in the different centres, and these were exhausted before the sub-alkaline magma again extruded the basic and sub-basic material. The magmas of intermediate composition began extruding basic material previous to the acid sub-alkaline extrusions, and while the latter were being exhausted, acid and sub-acid material of an intermediate nature was separated off and extruded; some of the most recent flows in the area were the last extrusions of a basic nature from these magmas.

TABLE X.

| —                                    | I.     | II.    | III.   | IV.    |
|--------------------------------------|--------|--------|--------|--------|
| SiO <sub>2</sub> .. ..               | 70.47  | 49.65  | 60.06  | 59.34  |
| Al <sub>2</sub> O <sub>3</sub> .. .. | 14.90  | 16.13  | 15.52  | 14.46  |
| Fe <sub>2</sub> O <sub>3</sub> .. .. | 1.63   | 5.47   | 3.55   | 2.67   |
| FeO .. ..                            | 1.68   | 6.45   | 4.06   | 5.99   |
| MgO .. ..                            | 0.98   | 6.14   | 3.56   | 3.97   |
| CaO .. ..                            | 2.17   | 9.07   | 5.62   | 5.53   |
| Na <sub>2</sub> O .. ..              | 3.31   | 3.24   | 3.28   | 3.59   |
| K <sub>2</sub> O .. ..               | 4.10   | 1.66   | 2.88   | 2.71   |
| TiO <sub>2</sub> .. ..               | 0.39   | 1.41   | 0.90   | 1.18   |
| P <sub>2</sub> O <sub>5</sub> .. ..  | 0.24   | 0.48   | 0.36   | 0.42   |
| MnO .. ..                            | 0.13   | 0.30   | 0.21   | 0.14   |
| Total ..                             | 100.00 | 100.00 | 100.00 | 100.00 |

I.—Average Composition of Granites of the World. (a)

II.—Average Composition of Basalts of the World. (a)

III.—Mean of I. and II.

IV.—Average Composition of Volcanic Rocks of the Area.

(a) Daly, Igneous Rocks.

The estimated average composition of the parent magma bears a close relationship to the mean of the world's average

granitic rock and the world's average basaltic rock. (See Table X.) Whether this has any significance or not it is difficult to say, but it is certainly a matter of interest in view of the fact that there are many ardent advocates of the view that there are two primary magmas, an acid and a basic one. In any case, a commingling of these two magmas could only be regarded as furnishing the magmatic material which became differentiated somewhat on the lines outlined above.

## IX. SUMMARY.

The area dealt with is one of 4,000 square miles, and is in the extreme south-eastern corner of Queensland.

The physical features have several marked characteristics, and a close relationship between them and the volcanic rocks exists.

Important earth movements of a vertical kind only have taken place since the Palæozoic era.

Volcanic rocks occur in great abundance, and the distribution of these rocks and their relationship to the sedimentary and metamorphic rocks of the area have been described and illustrated by means of a sketch-map and sketch-sections.

The maximum thickness of the volcanic products is approximately 3,000 feet, and three well-marked stratigraphic divisions of these have been definitely established.

A close correlation between these volcanic rocks and those of Cainozoic age in New South Wales and Victoria has been shown.

The upper division has a maximum thickness of 2,000 feet, which is common throughout a large portion of the area, and which is made up of a large number of flows of basalt, andesitic basalt, and andesite; in some places pyroclastic accumulations occur.

The middle division has a maximum thickness of 1,000 feet, and is made up of acid and sub-acid lava flows, plugs, and in the south of a very extensive development of acid pyroclastic material.

The lower division has a maximum thickness in one place of 1,500 feet, though 100 feet is the average thickness, and it is made up mainly of basic lavas with occasional flows of andesitic material.

The age of the activity which produced all the volcanic material of this area, with the exception of the Brisbane tuff, is believed to be Cainozoic, and that of the lower, middle and upper divisions to be of approximately lower, middle and upper Cainozoic age.

The evidence of previous observers, notably E. O. Marks and R. A. Wearne, in favour of an upper Trias-Jura age for portion of the extruded material has been critically examined and rejected in favour of a post-Trias-Jura age for all the material.

The field occurrence of the volcanic rocks is recorded and they are shown in all cases to rest on top of the uppermost Trias-Jura deposits.

Extrusions both from fissures and central vents have taken place, though the greater portion of the basic and sub-basic material has been effused quietly from fissures.

Rhyolites, trachytes, dacites, andesites and basalts have been recognised and petrographic descriptions recorded.

The distribution of trachytes as indicated by Dr. Jensen is criticised, also a general sketch-section through the area which he has published.

The chemical characters of the rocks are illustrated by thirty-five complete analyses, twenty-five of which have been recently made in the laboratory of the State Agricultural Chemist.

By means of variation diagrams, the genetic relationship existing between all the rocks is shown and three definite series have been recognised.

The three series are—(a) An alkaline series, the members of which range from acid to sub-acid, and belong to the middle division; (b) a sub-alkaline series, embracing

rocks from acid to basic, and occurring in all three divisions; and (c) a series intermediate between (a) and (b), containing rocks ranging from acid to basic and in all three divisions.

The chemical characters of the rocks in comparison with alkaline and sub-alkaline rocks in general is shown by means of variation diagrams. A general paucity in alumina with a corresponding richness in total iron-oxides, a slight lack of lime and magnesia, and a slight excess of alkalis, especially soda, are characteristic of both series.

It is considered improbable that the assimilation of limestone material &c. by the primary magma took place to form the partial magmas from which all the alkaline rocks were formed in this area.

An estimate of the chemical nature of the original parent magma from which all the volcanic rocks have been derived has been made, and compares very closely with that of the average andesite as given by Daly.

During the Cainozoic era, this area was a sub-alkaline province, but during the middle portion of the era, several small alkaline sub-provinces existed.

The volcanic alkaline rocks constitute at the most 5 per cent. of the volcanic material.

Harker's generalisation that sub-alkaline rocks are associated with folding earth movements is not borne out by the evidence from this area.

The nature of the parent magma, its differentiation with the resulting series of rocks, and the sequence of the flows have been discussed.

A geological sketch-map and four sketch-sections have been prepared to show the distribution, extent and stratigraphic relationships of the rocks of the area; also from the chemical analyses a number of variation diagrams and a set of Brögger diagrams have been drawn up to show the relationships of the volcanic rocks to one another; a series of microphotographs of the more important rocks is also appended.

In conclusion my best thanks are due to Mr. R. A. Wearne, B.A., of Ipswich, for invaluable aid in the field, to Mr. J. C. Brünnich the Agricultural Chemist and his officers, particularly Mr. G. Patten, for the many valuable rock-analyses which they have carried out, and to Professor E. W. Skeats, D.Sc., of the University of Melbourne, for very kindly criticisms.

## X. DESCRIPTION OF PLATES.

### *Plate V.*

#### BRÖGGER DIAGRAMS.

This shows Brögger diagrams for the thirty-five rocks whose analyses have been used to illustrate the chemical nature of the rocks. The diagrams are arranged in three divisions and show (*a*) the 18 rocks belonging to the sub-alkaline series, (*b*) the 9 rocks belonging to the intermediate series, and (*c*) the 8 rocks belonging to the alkaline series.

The diagrams have been drawn up in the usual way with the lengths laid off according to the molecular proportions of the different oxides; the iron-oxides have been calculated together as ferrous oxide.

An interesting comparison between the sub-alkaline and alkaline series is shown, and the differences between the lime, magnesia and alkalis are brought out in a striking manner.

The intermediate character of the third series is clearly indicated.

The numbers on the diagrams correspond to those of the rocks on Table VII. (page 183).

### *Plates VI.-IX.*

#### VARIATION DIAGRAMS.

These have been drawn up by plotting the silica percentages against the other oxides in percentages. In addition to the three curves for the three series, there are two curves as adapted by the author from curves drawn

up by Harker.<sup>51</sup> In this way a comparison is obtained, not only of the rocks under consideration, but also of these with the world's average alkaline and sub-alkaline series.

*Plate VI.* shows diagrams for lime and magnesia.

*Plate VII.* shows diagrams for soda, potash and also combined soda and potash.

*Plate VIII.* shows diagrams for alumina and total iron-oxides as ferrous oxide.

*Plate IX.* shows a diagram for combined alumina and total iron-oxides as ferrous oxide.

The numbers of the rocks correspond to those given on Table VII. (page 183).

### *Plate X.*

#### GEOLOGICAL SKETCH-MAP.

This is drawn up on a scale of six miles to an inch and is based on maps published by the Geological Survey and by H. I. Jensen, D.Sc., with additions and alterations by the author. It shows the extent and distribution of the volcanic rocks of the area. No attempt has been made to map in the other igneous rocks which intrude the Palæozoic rocks in the northern part of the area.

The basaltic and andesitic rocks of both the upper and lower divisions have been denoted by the same marking.

The thick black lines across the map indicate the lines of the sections shown on Plate XI.

### *Plate XI.*

#### GEOLOGICAL SKETCH-SECTIONS.

This contains four geological sketch-sections which have been drawn along lines which are marked on the map (Plate X.) by continuous thick black lines.

Fig. I.—Geological sketch-section in a north-easterly direction from the Main Range to Mount Flinders, and then east to the Pacific Ocean.

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<sup>51</sup> Harker, Nat. Hist. Igneous Rocks, pp. 150, 151

Fig. II.—Geological sketch-section in a general north-west direction from MacPherson's Range to the Albert River, north of Tamborine Plateau.

Fig. III.—Geological sketch-section north and south through Mount Lindsay.

Fig. IV.—Geological sketch-section east and west through Lamington Plateau.

These sketch-sections show clearly the relationships of volcanic rocks to the Mesozoic and Palæozoic rocks, the thickness of the volcanic rocks, and also the relative thicknesses of the upper, middle, and lower divisions of volcanic rocks in different places.

### *Plates XII.-XIV.*

#### MICRO-PHOTOGRAPHS.

All the micro-photographs are  $\times 30$ , and in ordinary light except where otherwise indicated.

#### *Plate XII.*

Fig. 1.—Pitchstone from Mount Lindsay, showing fluxion structure around a phenocryst of felspar. The felspar shows corrosion and a partial replacement by the brown glassy matrix. *Sp.* 228.

Fig. 2.—Perlitic pitchstone, Glass Cutting, Springbrook Plateau. *Sp.* 135.

Fig. 3.—Pitchstone, Moogerah School, near Mount Alford. It shows spherulites, axiolites and a phenocryst of felspar. *Sp.* 20x.

Fig. 4.—Rhyolite, Mount Lindsay. X nicols. *Sp.* 223.

Fig. 5.—Rhyolite, Mount Barney, showing micrographic structure. X nicols. *Sp.* 220.

Fig. 6.—Rhyolite, S.E. of Tamborine Plateau, shows microspherulitic structure. X nicols. *Sp.* 54c.

*Plate XIII.*

- Fig. 1.—Rhyolite, Glennie's Pulpit, Mount Alford, showing corroded phenocrysts of quartz and sanidine. X nicols. *Sp.* 101.
- Fig. 2.—Rhyolite, Glen Rock, Esk. *Sp.* 234.
- Fig. 3.—Volcanic Breccia, Lamington Glen, Christmas Creek. *Sp.* 99.
- Fig. 4.—Augite-Andesite, portion 28v, parish of Biarra, near Ottaba Station, showing the resorption borders around the augite phenocrysts. *Sp.* 224.
- Fig. 5.—Andesite, portion 18, parish of Witherin, Tamborine Plateau, showing the inclusions in the plagioclase phenocrysts, also the clear borders of the latter. *Sp.* 123.
- Fig. 6.—Andesite. One Tree Hill, Coolangatta. Showing one phenocryst of plagioclase with a zonal arrangement of inclusions, and another thickly studded with inclusions. *Sp.* 9.

*Plate XIV.*

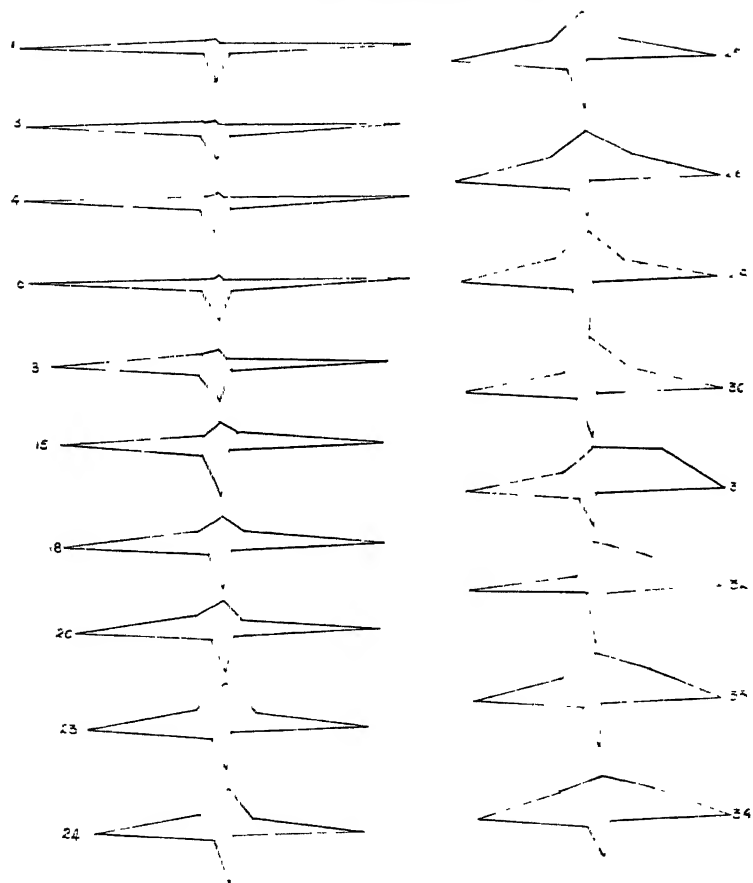
- Fig. 1.—Andesitic-Basalt, upper flow, Point Danger, showing portion of a large plagioclase phenocryst. X nicols. *Sp.* 11.
- Fig. 2.—Andesitic-Basalt, Lamington Plateau, showing phenocrysts of plagioclase and olivine, the latter mineral being much altered into iddingsite. X nicols. *Sp.* 85.
- Fig. 3.—Lower Basalt, Chinghee Creek, portion 69, parish of Telemon. *Sp.* 94.
- Fig. 4.—Basalt, Quarries, Bundamba, showing patches of glass thickly studded with rods of the iron-ores. *Sp.* 237.

Fig. 5.—Oligoclase Basalt, Spicer's Peak, showing a phenocryst of olivine altering into serpentine. The other dark patches are mainly chlorite. *Sp.* 116.

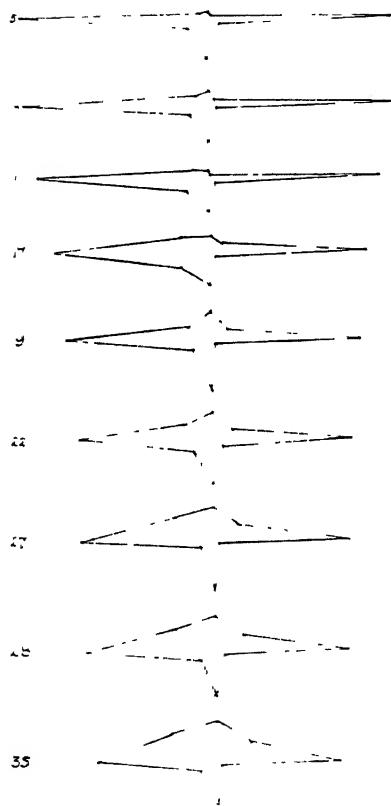
Fig. 6.—Basalt, 3,000-ft. level, south-east slope of Mount Lindsay, showing the very fine-grained nature, the fluxion structure and the somewhat banded appearance. *Sp.* 221.



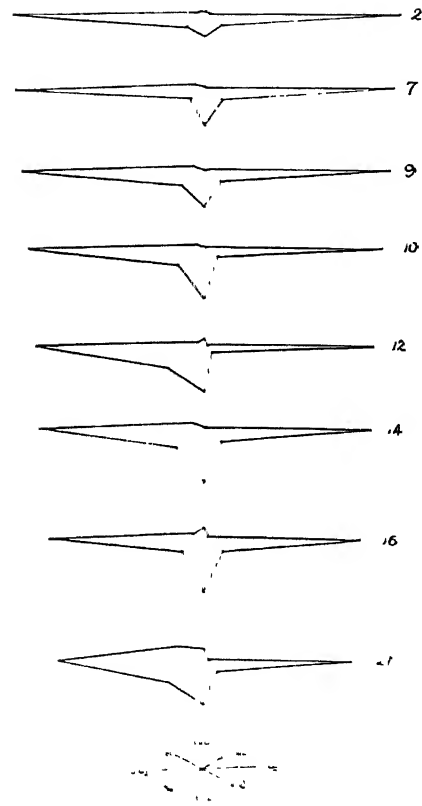
### SUB-ALKALINE SERIES



## INTERMEDIATE SERIES

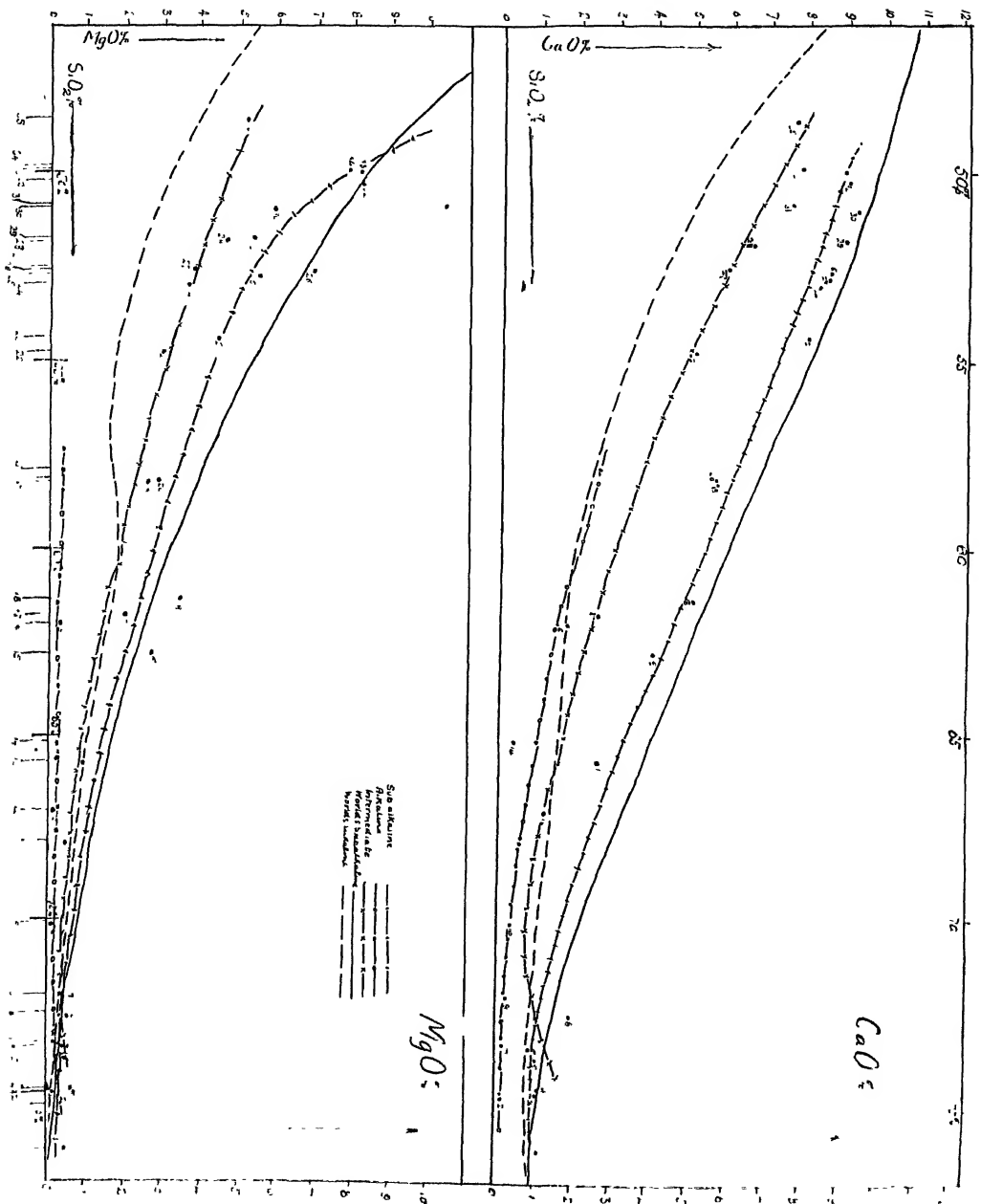


### ALKALINE SERIES

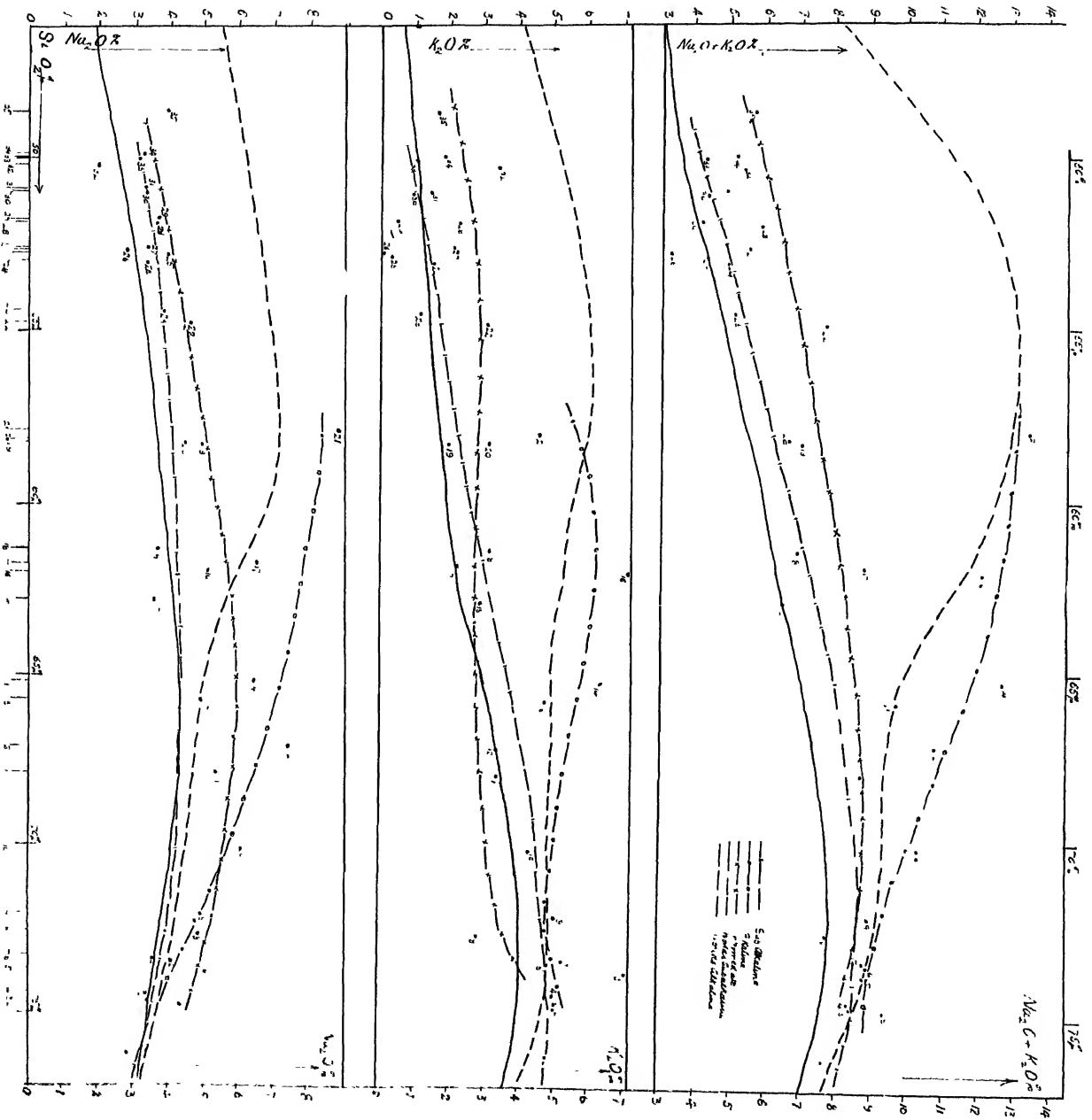


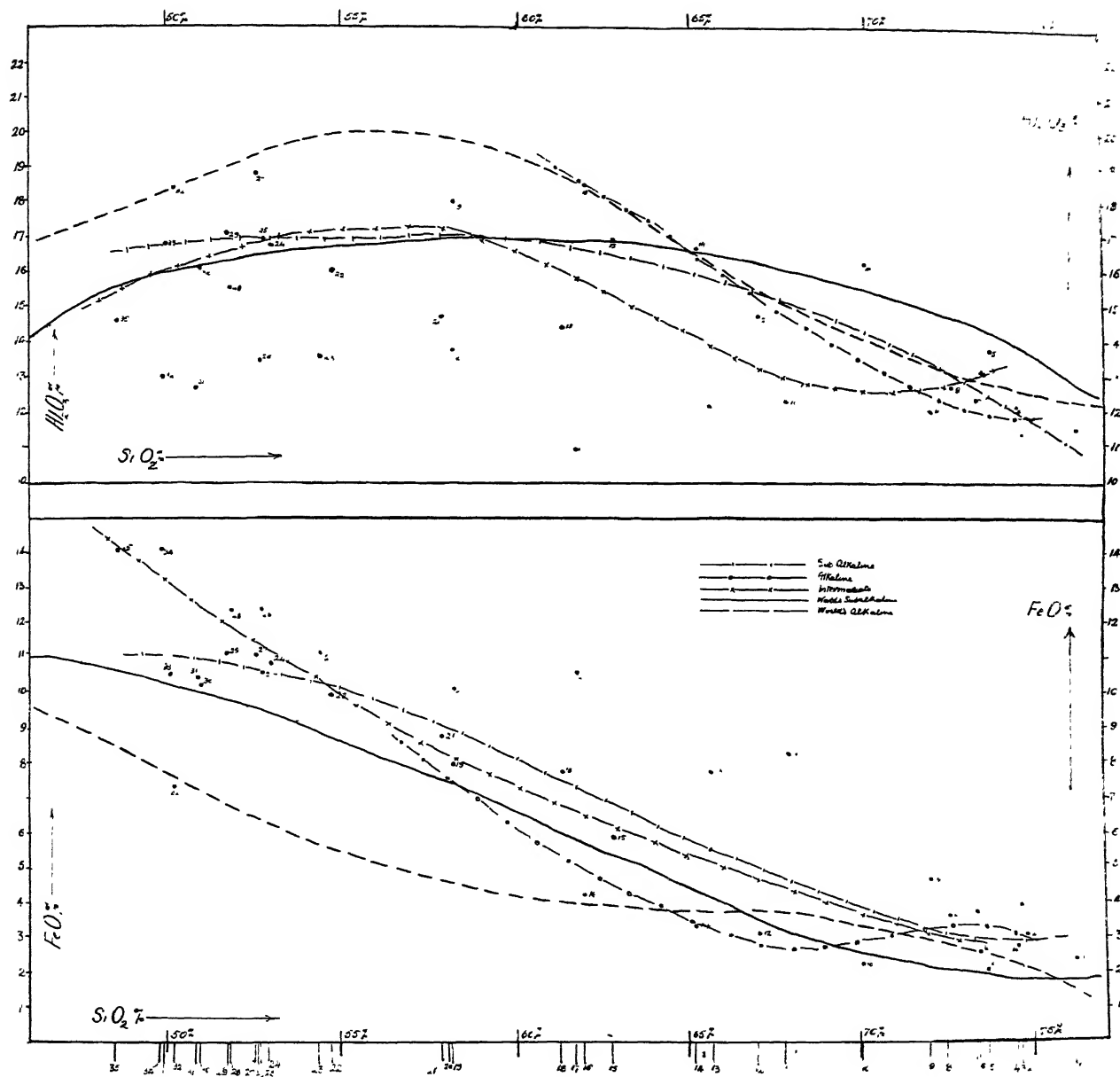






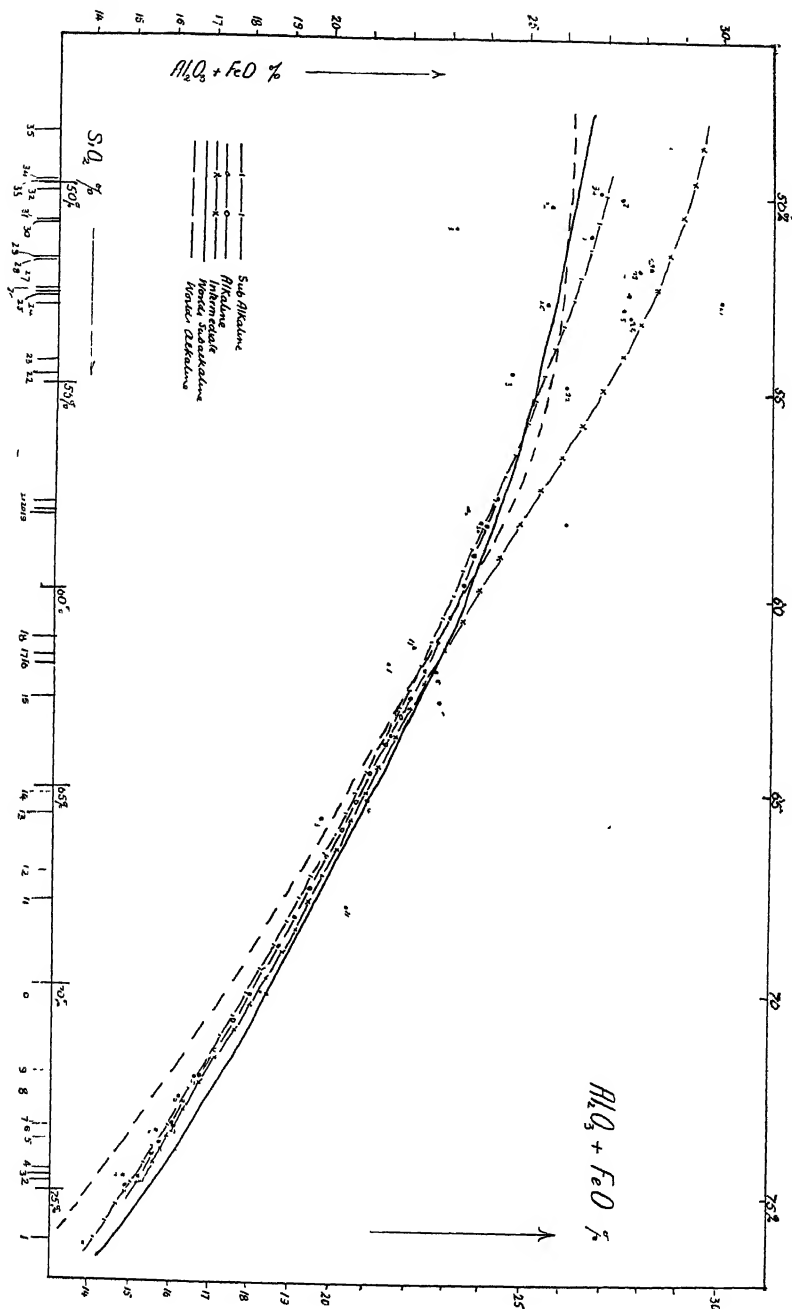




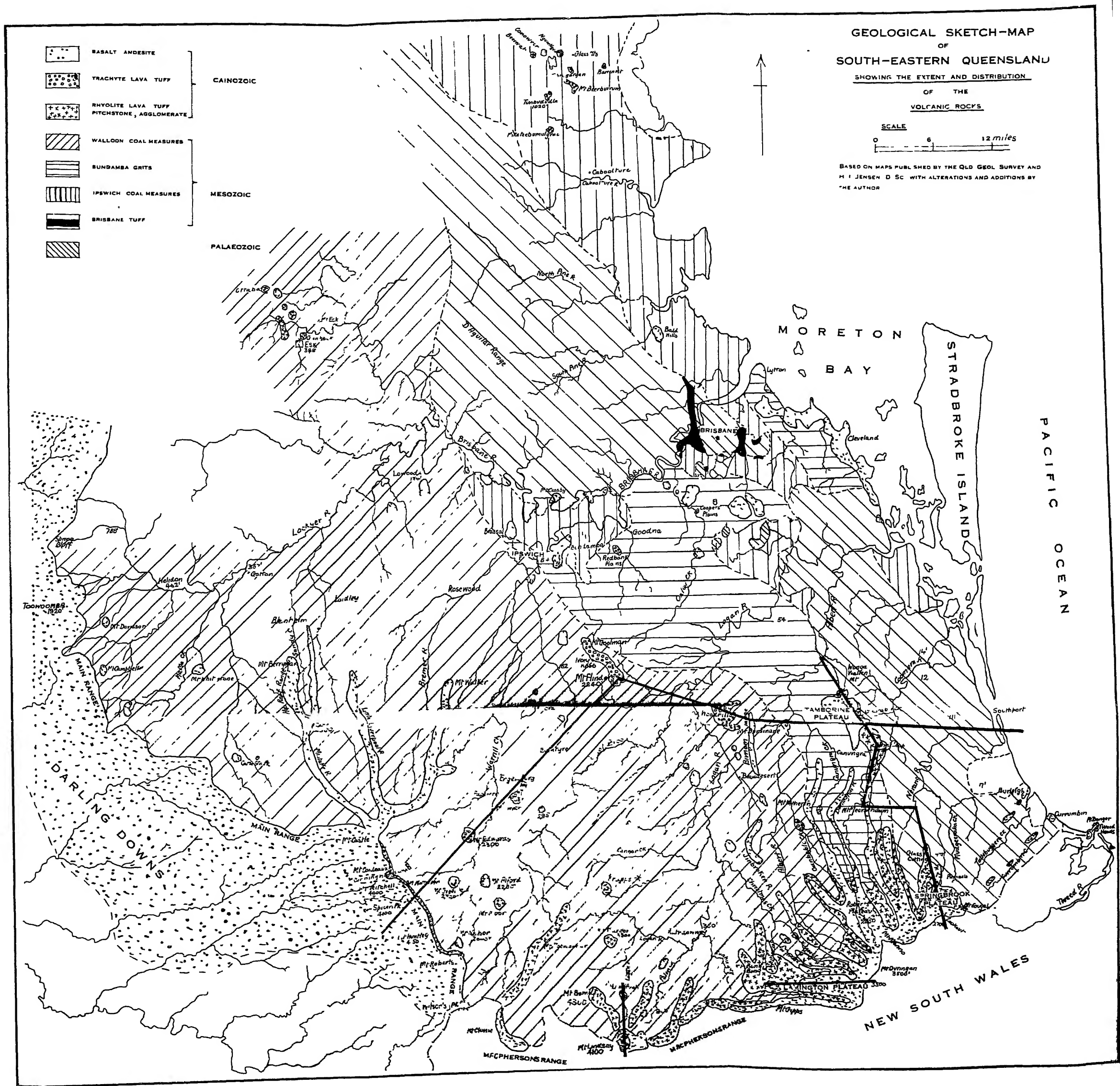












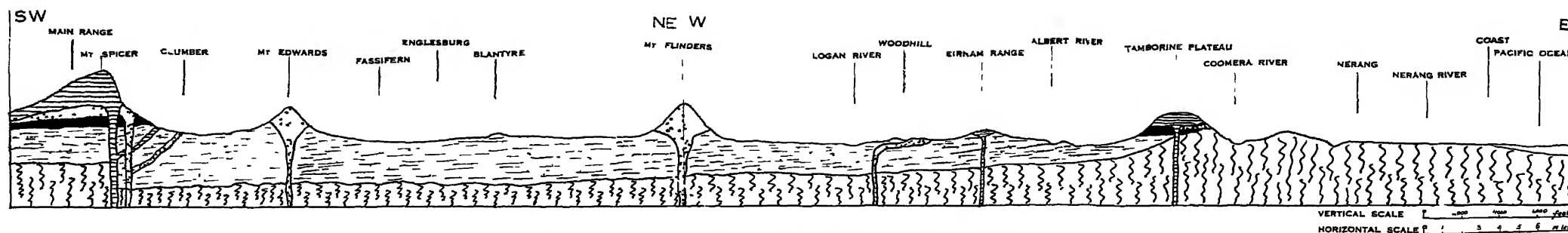


FIG. I. GEOLOGICAL SKETCH-SECTION N.E. FROM MAIN RANGE TO MT. FLINDERS AND EAST TO PACIFIC OCEAN.

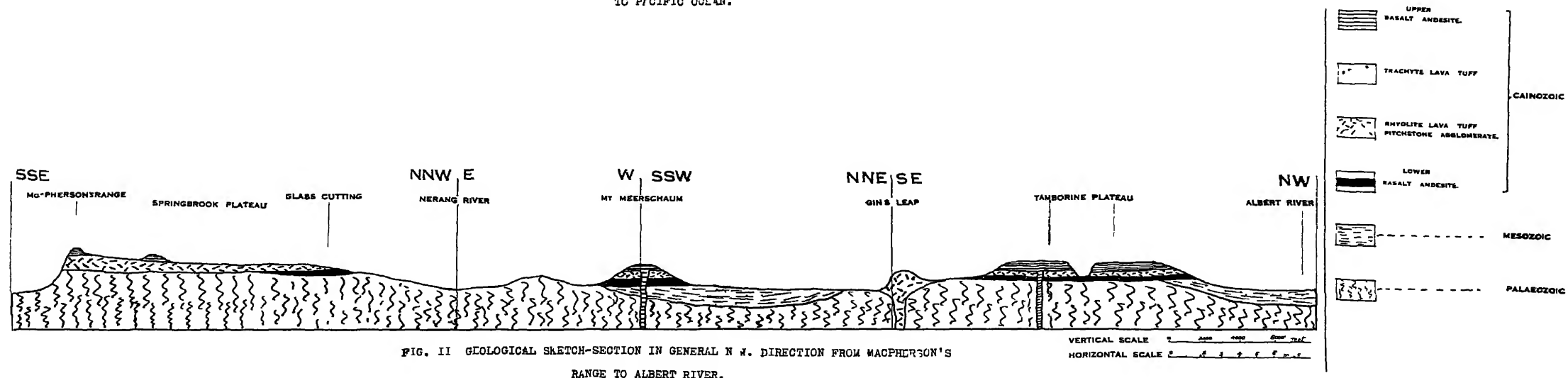


FIG. II GEOLOGICAL SKETCH-SECTION IN GENERAL N.W. DIRECTION FROM MACPHERSON'S RANGE TO ALBERT RIVER.

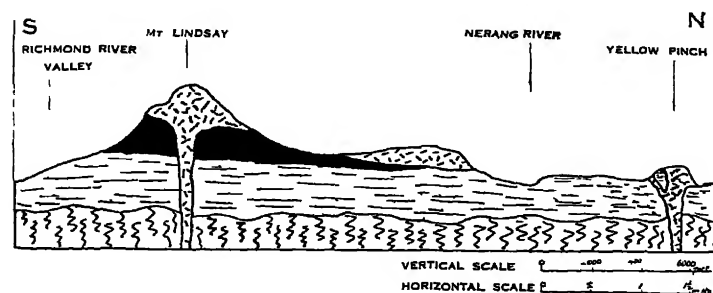


FIG. III. GEOLOGICAL SKETCH-SECTION N.&S THROUGH MT. LINDSAY.

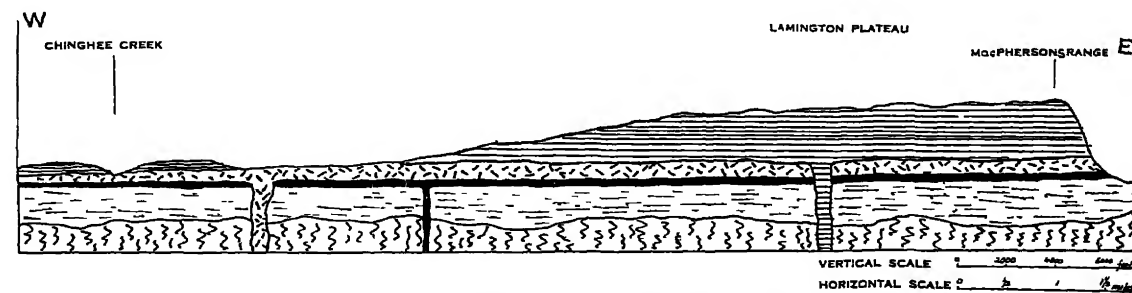


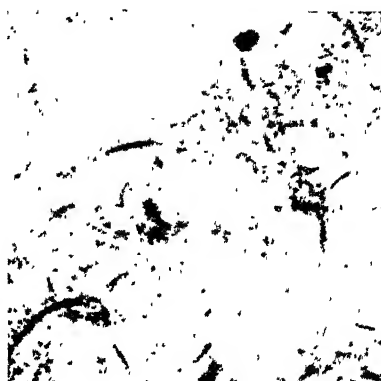
FIG. IV. GEOLOGICAL SKETCH-SECTION E & W. THROUGH LAMINGTON PLATEAU.



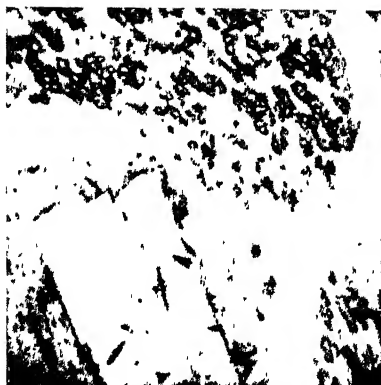




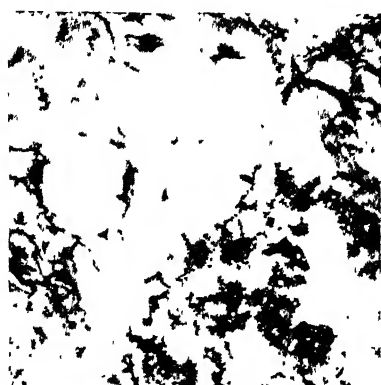
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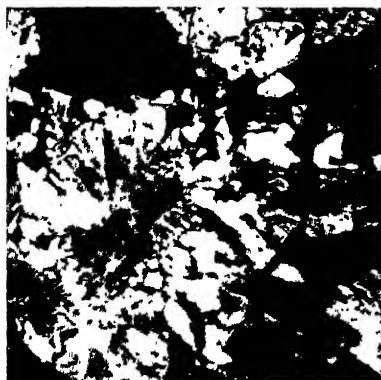
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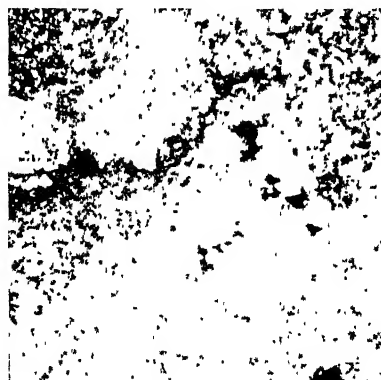
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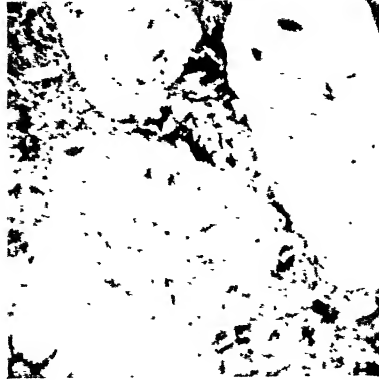
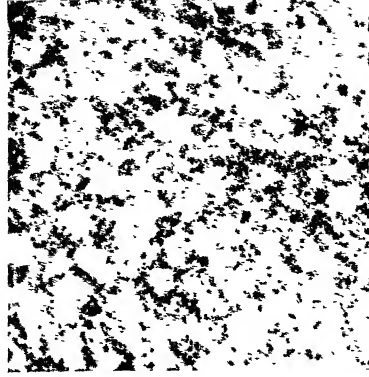
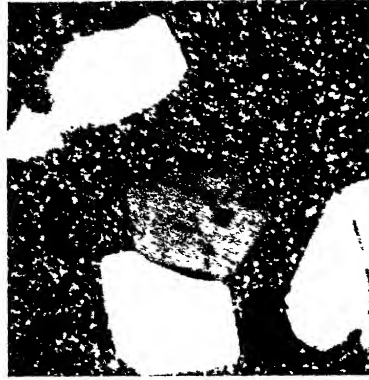


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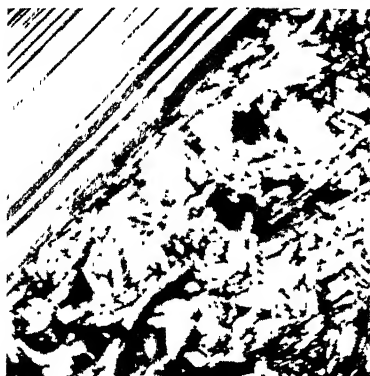


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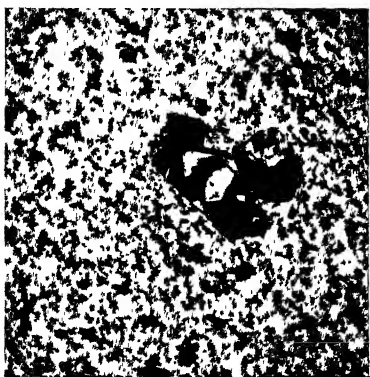
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## Abstract of Proceedings of the Royal Society of Queensland.

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ABSTRACT OF PROCEEDINGS, MARCH 29TH, 1915.

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Dr. J. Shirley, President, in the chair.

The Patron, His Excellency Sir Hamilton Goold-Adams, and Lady Goold-Adams and Mr. R. C. Morgan, A.D.C., were present.

Mr. T. R. Pearce was elected a member

Dr. F. Butler-Wood and Mr. J. Colvin were proposed for membership.

The Annual Report of the Council was adopted on the motion of Mr. J. B. Henderson, seconded by Dr. T. Harvey Johnston.

The Financial Statement was adopted on the motion of Mr. H. C. Richards, seconded by Dr. A. Jefferis Turner.

The President presented his retiring address entitled "A Review of Recent Australian Conchology," and delivered a popular discourse on the subject, illustrated by lantern slides.

His Excellency expressed his appreciation of the lecture, his thanks to the Society for its welcome and his acceptance of the office of Patron. He also expressed his interest in certain scientific matters, and indicated astronomy and anthropology as being worthy of the attention of the Royal Society.

The following office-bearers for the year 1915 were elected :—

Patron—His Excellency Sir Hamilton Goold-Adams, G.C.M.G., C.B., etc.

President—T. Harvey Johnston, M.A., D.Sc.

Vice-President—R. Hamlyn-Harris, D.Sc.

Hon. Secretary and Editor—A. B. Walkom, B.Sc.

Hon. Treasurer—E. H. Gurney.

Hon. Librarian—C. D. Gillies, B.Sc.

Council—W. R. Colledge, B. Dunstan, F.G.S., H. A. Longman, H. C. Richards, M.Sc., and J. Shirley, D.Sc.

Hon. Auditor—G. Watkins.

# THE ROYAL SOCIETY OF QUEENSLAND

## FINANCIAL STATEMENT for the Year 1915.

Dr.

Cr.

| RECEIPTS.                            |    |          | EXPENDITURE.                       |    |          |
|--------------------------------------|----|----------|------------------------------------|----|----------|
|                                      | £  | s. d.    |                                    | £  | s. d.    |
| To Balance from 1913                 | .. | 18 11 10 | By Printing (Pole & Co.)—          |    |          |
| „ „ Admission Fees and Subscriptions | .. | 80 6 6   | 1913 Proceedings                   | .. | 15 0 0   |
| „ „ Sale of Proceedings              | .. | 2 8 0    | General                            | .. | 15 16 0  |
| „ „ Sundry Small Receipts            | .. | 0 1 8    |                                    |    | 30 10 0  |
|                                      |    |          | Postage                            | .. | ..       |
|                                      |    |          | Monthly Notices                    | .. | 3 4 0    |
|                                      |    |          | Librarian's Postage and Postage on |    |          |
|                                      |    |          | 1913 Proceedings                   | .. | 5 10 6   |
|                                      |    |          | Geological Section's               | .. | 0 10 0   |
|                                      |    |          | Nat. History Section's             | .. | 0 10 0   |
|                                      |    |          | Editor's                           | .. | 0 10 0   |
|                                      |    |          | Insurance                          | .. | 10 4 6   |
|                                      |    |          | General Postage and Petty Cash     | .. | 1 2 6    |
|                                      |    |          | Cartage                            | .. | 5 15 5   |
|                                      |    |          | Caretaker and Refreshments         | .. | 0 9 3    |
|                                      |    |          | Cab Fares (Funeral)                | .. | 2 5 0    |
|                                      |    |          | Bank Charge                        | .. | 0 12 6   |
|                                      |    |          | Balance as per Bank Book           | .. | 0 10 0   |
|                                      |    |          |                                    | .. | 49 12 10 |
|                                      |    |          |                                    |    | £101 8 0 |

Examined and found correct.

GEO. WATKINS, Hon. Auditor.

BRISBANE, February 15th, 1916.

J. C. BRÜNNICH,  
Hon. Treasurer.

## ABSTRACT OF PROCEEDINGS, APRIL 26TH, 1915.

The Ordinary monthly meeting was held in the Geology Lecture Theatre in the University at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

Dr. Johnston thanked members for his election to the office of president, and took the opportunity of recording the members' appreciation of the work done by the retiring Honorary Secretary (Mr. F. Bennett) during his years of office.

The minutes of the special meeting of November 30th, 1914, were read and confirmed.

Mr. J. R. Cullen, of Montville, and Miss Irene V. Butler-Wood, B.D.S., were proposed as ordinary members, and Miss Edna Peberdy as an associate member of the Society.

Dr. F. Butler-Wood and Mr. J. Colvin were elected members.

The Library exchanges and donations for the month were laid on the table.

*The following papers were read :*

- (1.) Studies in Australian Lepidoptera, by A. Jefferis Turner, M.D., F.E.S.

Fifty-seven genera and 82 species are dealt with, of which 10 genera and 49 species are new. They are mainly from Queensland localities, a few being from other Australian States.

- (2.) The Nature and Origin of Manganiferous and Ferruginous Incrustations and Deposits, by W. D. Francis.

The subject is treated under the headings of incrustations, bog-iron ore and bog-manganese, and the disintegration of rocks. Incrustations are divided into fluvatile, subærial, internal, marine and corrosive (chiefly iron rust). The author is opposed to the theory that incrustations of various types, accumulations of bog-iron ore and bog-manganese, and the disintegration of rocks are brought about by chemical action, and holds that these phenomena are occasioned almost completely, if not wholly, by organic

agents. Incrustations such as manganiferous and ferruginous coatings, dendritic markings, etc., are ascribed to the decay and alteration of encrusting algæ and lichens, or of colonies of bacteria. To the latter are also ascribed accumulations of bog-iron ore and bog-manganese. The disintegration of rocks is held to be brought about by the attack of bacteria on their carbonaceous, ferruginous and other constituents and the consequent breaking down and loosening of the originally compact and resistant rock substance.

In the discussion on the paper it was generally conceded that the author had made certain interesting observations but his deductions were almost entirely disagreed with. The difficulty of carrying out efficient experiments with bacteria was pointed out and the wish was expressed that more should be known about the conditions under which the experiments had been carried out before any reliable conclusions could be drawn from them. Messrs. Gurney, Richards, Smith and Walkom and the President took part in the discussion.

#### NOTES AND EXHIBITS.

Dr. T. H. Johnston exhibited some interesting polypes (? *Corymorpha*) which were living as messmates on a crab; also some simple corals (? *Cylicia*). All of these specimens were collected by dredging recently in Bribie Passage. He also exhibited a worm, *Gordius* sp., which was found by Mr. H. A. Longman in freshwater at Montville. In its young stage this animal lives as a parasite on certain insects.

Mr. C. T. White exhibited specimens of (i) *Nostoc commune*, a widely-spread species of alga recently recorded from Queensland. The specimens were found growing in damp soil on the Brisbane River. (ii) *Sporochnus pedunculatus* collected recently in Moreton Bay, a species of alga new to Queensland waters. Also a fungus, *Morchella rotundata*, var. *fulva*, an European species recently found by him growing in quantity at Fig Tree Pocket, Brisbane River.

Mr. H. A. Longman exhibited a live specimen of *Physignathus lesueurii* from Montville and a giant cricket.

ABSTRACT OF PROCEEDINGS, MAY 31ST, 1915

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The Ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President extended the Society's congratulations to Mr. W. H. Bryan, B.Sc., as being the first member of the Society to enlist for active service. He also expressed the sincere sympathy of members with Miss Bage in the loss of her brother in action at the Dardanelles, and with Mrs. De Vis in the loss of her husband, who was formerly one of our most prominent members. Dr. Hamlyn-Harris and Mr. H. A. Longman spoke in appreciation of the late Mr. De Vis and his work.

The minutes of the previous meeting were read and confirmed.

Mr. Dene B. Fry was proposed as an Ordinary Member, and Miss Margaret Mackenzie as an Associate Member of the Society.

Mr. J. R. Cullen and Miss Irene V. Butler-Wood were elected Ordinary Members, and Miss Edna Peberdy an Associate Member.

*The following paper was read :*

Herpetological Notes, by Dene B. Fry (communicated by Mr. H. A. Longman).

The paper comprised four parts, viz. :

- (i) Description and Notes on three Lizards. The species *Edura monilis*, De Vis, is redescribed and notes given on *Calotes cristatellus*, Kuhl, and *Gonyoccephalus spinipes*, A. Dum.
- (ii) On a new *Chelodina* with a key to the genus. A new species is described as *C. intergularis*.
- (iii) Two new species of *Pseudelaps* and a key to the genus. *P. christieanus*, sp. nov., is described from Port Darwin, and *P. minutus* from three localities in New South Wales.

- (iv) A new Queensland Frog. *Austrochaperina brevipēs*, sp. nov., is described from the Bloomfield River, near Cooktown, Queensland.

#### NOTES AND EXHIBITS.

Mr. H. A. Longman exhibited a live specimen of *Phyllurus platurus*

Dr. R. Hamlyn-Harris exhibited (1) some native knitting needles and opossum-fur twine from Groote Eylandt. It was pointed out that the natives there had been singularly isolated, and beyond possible influence from Malay had not been affected by contact with civilization: hence the significance of the specimens. The twine consists of series of lengths of fur of about three-quarters of an inch, and these are united by being junctioned into clumps, presenting an almost moniliform appearance. (2) Two unpointed and rather roughly manufactured Death-bones were shown from the Mitchell River, Queensland. These specimens, which had actually been responsible for the death of two individuals, clearly demonstrated that in the olden days the natives used implements unlike the ordinary type, which may be compared to the elongated bone sewing-needle (example exhibited). (3) Poison carriers from the Roper River. These are made from the wing bones of the Pelican and are of special interest, and they point to the use of such things as arsenic as a modern idea. Whether here, as in Melanesia, the natural properties of poisons were disputed and their noxious results attributed to magic charms is an interesting question by no means easily solved. (4) A magical rain stick.

Mr. A. B. Walkom, by permission of the Director of the Queensland Museum, exhibited a specimen of *Annularia* associated with *Glossopteris* from Permo-Carboniferous rocks near Dunedoo, New South Wales. The specimen is of a type somewhat similar to *A. stellata* (Schloth), and is quite distinct from the only species of *Annularia* (*A. australis*) of which record can be found in rocks of this age in Australia.

Dr. T. H. Johnston exhibited a series of specimens of *Ceratodus*.

## ABSTRACT OF PROCEEDINGS, JUNE 28th, 1915.

A Special Monthly Meeting was held in the Geology Lecture Theatre in the University at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President referred to the loss sustained by the Society in the death of Mr. F. M. Bailey. The late Mr. Bailey had been a member of the Society since its inception, and in the earlier years took a very active part, having been President one year, Vice-President one year, and a member of the Council for fifteen years. He had also made twenty-one contributions to our Proceedings, in addition to many outside publications. Messrs. Longman and Colledge also spoke in appreciation of Mr. Bailey and his work.

The President also extended a welcome to Mr. Bridwell, Entomologist to the Hawaiian Government.

The minutes of the preceding meeting were read and confirmed.

Mr. H. A. Longman proposed "That the Society suspend the annual subscriptions of ordinary members on active service." Dr. Hamlyn-Harris seconded the motion, which was carried unanimously.

The exchanges and donations for the month were laid on the table.

Mr. Dene B. Fry was elected an Ordinary Member, and Miss Margaret Mackenzie an Associate Member of the Society.

*The following paper was read :—*

Herpetological Notes : Descriptions of Some Australian and Papuan Frogs ; by Dene B. Fry.

The paper was communicated by Mr. H. A. Longman.

Mr. Bridwell and the President offered remarks on the paper.

Mr. Bridwell, at the invitation of the President, gave an account of some of his experiences while engaged in scientific work in W. Africa.

NOTES AND EXHIBITS :—

Dr. T. H. Johnston exhibited specimens of *Acetabularia* sp. dredged by him in Pumice Stone Passage between Bribia

Island and the mainland. They were found at a few fathoms depth on a soft, muddy bottom, along with *Zostera marina* and *Halophyllum ovatum*.

Dr. R. Hamlyn-Harris exhibited a number of stone, iron and other implements of the Queensland Aborigines. He stated that the interest of the specimens lay in the fact that whereas some were genuine stone implements of the palæolithic stage of culture, others, having been manufactured quite recently, represented a temporary transition stage rapidly evolved through contact with civilization. This hastened disappearance of accurate and genuine workmanship on the part of these primitive people, whereby their trade becomes a lost art, emphasises with considerable force the necessity of saving the few remaining records before it is too late. Amongst the exhibits some very indifferently-worked knives and axes, shown in contrast with the genuine article, are evidences of the crudeness of the modern bungler. Since the introduction of such things as flakes of glass bottles and pieces of iron gives an already partially-manufactured product easily adapted to modern use, the native, however slightly civilised he may be, soon prefers to relinquish the arduous methods of old-time manufacture for the more easily acquired modern appliances placed in his hands.

Mr. H. A. Longman exhibited a specimen, seven feet in length, of *Acrochordus javanicus*, Hornst., obtained by Mr. Esmond Parkinson in the Leichhardt River, Gulf of Carpentaria, and forwarded to the Queensland Museum. This snake has not previously been recorded for Australia, but examples are occasionally found in or near rivers in the Malay Peninsula, Java, Siam and Papua. The species is non-venomous, and belongs to the *Aglypha* series.

#### ABSTRACT OF PROCEEDINGS, JULY 26TH, 1915.

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The ordinary monthly meeting was held in the Geology Lecture Theatre, in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President extended the congratulations of the Society to Mr. J. F. Bailey on his appointment to the position of Colonial Botanist.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

*The following paper was read :—*

“Notes on a few interesting plants from Moreton Bay,” by C. T. White.

The paper consists mainly of records of occurrences of plants which have not previously been recorded from the Moreton Bay District.

Mr. Longman and the President remarked on the paper and congratulated Mr. White on his first contribution to the Proceedings.

Mr. J. C. Bridwell delivered a lecture entitled “The Use of Parasites in Economic Entomology.” The lecture was illustrated by many diagrams and lantern slides.

#### NOTES AND EXHIBITS.

Mr. H. A. Longman exhibited a portion of the fore part of a fossil cranium with a fragment of tooth, received from North Western Queensland, which apparently represented an animal quite new to Australia. Although too fragmentary to be definitely allocated, some slight resemblance might be traced to the Dicynodonts of South Africa.

#### ABSTRACT OF PROCEEDINGS, AUGUST 30TH, 1915.

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The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

*The following paper was read :—*

"A List of the Recorded Freshwater Protozoa of Queensland, with a number of new records," by C. D. Gillies, B.Sc.

The paper contains an addition of 14 species to the recorded freshwater Protozoa of Queensland, together with a list of previously recorded forms.

#### NOTES AND EXHIBITS.

Dr. Shirley exhibited shells from North West Is., collected by Miss Peberdy. They included; *Atactodea striata*, Gmel.; *Trochus calcaratus*, Souv.; *Chrysostoma paradoxa*, Born.; *Quoyia decollata* Q. & G.; *Cerithium columna*, Sby.; *C. hanleyi*, Sby.; *C. rubum*, Martyn; *C. granosum*, Kien; *Clava aspera*, L.; *C. vertaga*, L.; *Natica chinensis*, Lam.; *Cypræa isabella*, L.; *C. annulus*, L.; *C. caurica*, L.; *C. erronea*, L.; *Conus spectrum*, L.; *Arcularia jonasi*, Dunk (=nana, A. Ad.).

Except *Cerithium hanleyi*, most of these shells are of very extensive range. *Quoyia decollata* has been reported from Ascension I., and *Clava aspera* from Madagascar; the rest range widely over the E. Indian Islands or Western Polynesia, or both.

Mr. C. T. White exhibited specimens of *Erigeron linifolius*, Willd.; *E. canadensis*, Linn, and *Aster subulatus*, Michx., from the Queensland Herbarium, by permission of the Govt. Botanist. The latter species, for some time recorded as naturalised in Victoria and N.S.W., has previously gone in Queensland as a glabrous form of *E. canadensis*, but the normal form of that species has now appeared in several places in Queensland, and the two when seen growing together are very distinct.

Mr. H. A. Longman exhibited the following Queensland Museum specimens: (1) A fragment of the left maxilla with three abraded molars of a *Diprotodon* from the Flinders River, near Hughenden, donated by Mr. R. Pool, the locality record being of considerable interest; (2) dermal ossifications and a disarticulated cranium of *Trachysaurus rugosus*, the parietal region showing interiorly an infundibular pit for the accommodation of the epiphysial diverticulum of the pineal body; (3) a living *Typhlops*

*wiedii*: this "blind snake" shows unusual transparency for a land vertebrate, and when held before a strong light its viscera may be discerned and the pulsations of the heart noted.

Dr. Hamlyn-Harris exhibited a Fijian chief's necklet made of a sperm whale's tooth, highly polished, with a cord of plaited and twisted vegetable fibre, much prized and formerly a sort of native currency. Also a fine set of shell implements collected recently by him from several native camps on Dunk Island, the knives and spoke-shaves being made from a species of *Perna*. A very interesting implement was a triangular (shark tooth shaped) scarifying implement, evidently used by the natives for the purpose of making tribal and other decorative marks. The set of implements demonstrated the manufacture of shell fish-hooks. Discs of about an inch or so square are cut from the black-lip shell, *Margaritifera margaritifera*; a centre hole is pierced by means of a quartz drill until the aperture is sufficiently large to admit of the use of the small coral files which further enlarge the hole. The discs are then divided into two and worked down until the proper crescent-shaped fish-hook is sufficiently pointed to render it of service. Some weathered pieces of a species of *Chama* were shown, these being of a similar shape to the fish hooks, and thought by some to have given the aboriginal the first idea of shape. Another interesting exhibit was an aboriginal plane made of a land shell (*Xanthomelum pachystyloides*), bearing the native name "KURRA DJU." This implement is used for planing the fruit of the Moreton Bay Chestnut (*Castanospermum australe*)—native name "TINDABURRA"—the operator being able to regulate the thickness of the shaving to a nicety.

#### ABSTRACT OF PROCEEDINGS, SEPTEMBER 27th, 1915.

The ordinary monthly meeting was held in the Géology Lecture Theatre, in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President expressed the sympathy of the Society with the relatives of the late Mr. C. W. Costin, who had been a member of the Society from 1906 to 1914.

The President, on behalf of the members, congratulated Mr. H. C. Richards on having been awarded the degree of Doctor of Science by the University of Melbourne.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

Mr. R. J. Tillyard, M.A., B.Sc., F.E.S., Macleay Fellow of the Linnean Society of N.S.W. in Zoology, delivered a lecture on the "Life History of the Dragon Fly." The lecture was illustrated by a series of specimens and numerous lantern slides.

Messrs. Tryon, Illidge, Colledge, Dr. Shirley and the President spoke in appreciation of the lecture.

#### ABSTRACT OF PROCEEDINGS, OCTOBER 25TH, 1915.

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The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

Mr. J. Bain was proposed as a member of the Society.

The President gave a short account of a further communication from Mr. Francis, of Kin-Kin, regarding fluviatile and sub-aerial incrustations, which Mr. Francis believes to be of organic origin.

Dr. R. Hamlyn-Harris spoke in the interests of sociological anthropology, and by a number of illustrations, specimens and lantern views, showed how important this study was, and how the scope and significance of the subject, especially in its relationship to the vanishing race in Queensland, had not yet been realised.

He emphasised particularly some of the points so ably brought forward by Sir J. G. Frazer, whose comprehensive study of man as a whole, and whose methods of tabulating a multitude of facts, and presenting a critical analysis

thereof, have enabled us to take a broad general view of the whole subject, and also to realise the necessity for further work on special details. He pointed out, however, that the time for "dilly-dallying" had passed, and that unless we set to work earnestly and sincerely to save such records as remain, we should not be without responsibility, and the stigma of disgrace would not be undeserved. He therefore urged the Royal Society of Queensland to take the matter more seriously, and to give it the attention it deserved. Amongst the exhibits shown were:—(1) A native pillow, made entirely of emu feathers. This is the first instance of anything of the kind having reached us. The habit of sleeping with only the flat ground beneath the head being universal throughout Queensland. (2) A series of eel-bone charms from the Atherton District, made from the pectoral girdle and branchiostegal rays of the eel, mounted in gum cement. It would appear that these were in use by young boys when being initiated into manhood. They are worn hanging on the chest, and the opposing tribe is supposed to throw spears at them during the ceremonies. The native name is "WAK-KEE." (3) A charm which seems to be connected with revenge. The flat stick, the ends of which are ovate-spatulate, has stretched along its surface a piece of human skin which is kept in place by being tightly wound round with a species of pliable cane, but beyond the fact that the specimen was taken forty years ago in the Marlborough District by Mr. T. Illidge, no information is available. These and many other exhibits showed how extremely necessary a proper understanding of the native is. The idea was beginning to take root, that as soon as possible a scientific expedition should be equipped and sent to the more remote parts of the State, ere the sands had entirely run out.

Dr. Shirley, Mr. T. Illidge, Dr. Butler-Wood, and the President contributed to the discussion.

Mr. J. F. Bailey exhibited a cassowary's egg.

#### ABSTRACT OF PROCEEDINGS, NOVEMBER 15TH, 1915.

An extraordinary meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President announced that, owing to the increase in the number of members carrying out research, the Society had been unable to print all the papers offering this year. The Government had been approached and had very generously come to our assistance by offering to print the paper on "The Volcanic Rocks of South Eastern Queensland." by Dr. H. C. Richards. He took the opportunity of sincerely thanking the Government on behalf of the Society.

The President also congratulated Mr. F. Bennett, the late Honorary Secretary, on having qualified for the degree of B.Sc. of the Queensland University.

Dr. Richards read his paper on "The Volcanic Rocks of South Eastern Queensland." illustrating it with a number of lantern slides and projections of rock slides.

Remarks were made by Messrs. R. A. Wearne, E. H. Gurney, H. A. Longman and A. B. Walkom.

Dr. Hamlyn Harris exhibited a small aboriginal "camp" collection from near Bundaberg.

Mr. C. T. White exhibited part of a stem and long aerial root of *Tinospora smilacina*, Benth., a large menispermaceous climber from the Rosewood scrub, Southern Queensland. Many species of the genus *Tinospora*, when the stem is cut, send down from the severed portion a slender shoot which lengthens till it reaches the ground, often from great heights. In the "Queensland Flora." *T. smilacina* is recorded only from Cape York and Thursday Is., but numerous specimens have since been received and the plant shown to have a wide range in Queensland. It has also been recorded from Northern N.S.W.

#### ABSTRACT OF PROCEEDINGS, NOVEMBER 29TH, 1915.

The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The minutes of the previous meetings were taken as read.

His Excellency the Governor delivered an address entitled "Sidelights on South African History within the past thirty years."

The lecture dealt with many incidents which occurred during His Excellency's administration in South Africa.

Dr. R. Hamlyn Harris moved a vote of thanks to His Excellency, which was seconded by Mr. J. B. Henderson, and carried by acclamation.

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## Abstract of Proceedings of Geology Section.

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MEETING, APRIL 9TH, 1915.

Mr. Dunstan in the chair.

Twelve Members present.

Office-bearers for 1915, were elected as follows :—

President, B. Dunstan, F.G.S. ; Vice-president, H. C. Richards, M.Sc. ; Hon. Secretary, W. E. Cameron, B.A.

A discussion, which was opened by Dr. Shirley, took place on the Oxley Beds.

MEETING, MAY 17TH, 1915.

Mr. Dunstan in the chair.

Eight Members present.

The subject for discussion was "The Permo-Carboniferous Beds of Eastern Australia"; the discussion was opened by Mr. A. B. Walkom.

MEETING, JULY 30TH, 1915.

Mr. Dunstan in the chair.

Six Members and one visitor present.

Mr. Reid gave an account of the *Glossopteris* bearing beds of Bett's Creek, of Permo-Carboniferous age. A general discussion on these beds followed.

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## Abstract of Proceedings of Biology Section.

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### MEETING, APRIL 20TH, 1915.

Seven Members present.

Paper given by Mr. Watkins on Origin and Development of the Dahlia. He drew attention to the importance of this flower from the point of view of hybridisation and evolution.

### MEETING, MAY 11th, 1915.

Six Members and two visitors present.

Dr. Hamlyn-Harris gave an account of "Magic and Superstition," as exhibited by the Australian aboriginal. Several specimens of death-bone and charms of various kinds were shown.

Mr. Watkins added a few remarks.

### MEETING, AUGUST 18th, 1915.

Five members present.

Mr. C. T. White read a paper on "Queensland Ferns," and suggested that much of the work done by Domin in this connection might be revised.

Dr. Shirley and Mr. Longman took part in the discussion, Dr. Shirley pointing out that though much careful work had been done by Domin his localities were few.

Microscope slides of ferns were exhibited.

### MEETING, SEPTEMBER 14th, 1915.

Five members present.

Dr. Shirley gave a summary of Andrews' paper on "Myrtaceæ." He pointed out an interesting fact in evolution shown by the reversion to type exhibited by the young leaves of the Eucalypt to that of the parent Myrtle.

Messrs. White and Watkins took part in the discussion on the paper.

### MEETING, OCTOBER 20th, 1915.

Five members present.

Paper given by Mr. Colledge on the "Occurrence of Polyzoa in Brisbane water." Three species were described, and specimens, both living and mounted, were exhibited under the microscope.

Dr. Shirley and Mr. White spoke in appreciation of the paper.

## List of Societies and Institutions with which the Royal Society of Queensland exchanges Publications.

### AFRICA.

#### SOUTH AFRICA.

- Geological Commission, Cape of Good Hope.
- Natal Museum.
- South African Association for the Advancement of Science.
- South African Museum, Capetown.

#### NORTH AMERICA.

#### CANADA.

- Canadian Institute.
- Department of Mines.
- Hamilton Association.
- Literary and Historical Society, Quebec.
- Nova Scotia Institute of Natural Science.
- Royal Astronomical Society of Canada.
- Royal Society of Canada.

#### MEXICO.

- Instituto Geologico de Mexico.
- Meteorologico Observatorio.
- Sociedad Cientifica, Mexico.

#### UNITED STATES.

- Academy of Natural Sciences, Philadelphia.
- Academy of Science, Rochester, N.Y.
- American Academy of Arts and Sciences, Boston.
- American Geographical Society, N.Y.
- American Mathematical Society, N.Y.
- American Museum of Natural History, N.Y.
- American Philosophical Society, Philadelphia.
- Boston Society of Natural History

#### UNITED STATES—Continued.

- Buffalo Society of Natural History.
- Californian Academy of Science.
- Carnegie Institute.
- Colorado State College.
- Dept. of Agriculture, Washington, D.C.
- Dept. of Commerce and Labour, Washington, D.C.
- Field Museum of Natural History, Chicago.
- Florida Geological Survey.
- Geographical Society of Philadelphia.
- Geological and Natural History Society of Minnesota.
- Geological Survey of California.
- Geological Survey of U.S.A., Washington, D.C.
- Illinois State Laboratory.
- Indiana Academy of Science.
- Kansas Academy of Science.
- Lloyd Library, Cincinnati.
- Massachusetts General Hospital.
- Michigan Academy of Science.
- Minnesota Academy of Natural Science.
- Missouri Botanic Gardens, St. Louis.
- National Academy of Sciences.
- New York Academy of Sciences.
- New York Zoological Society.
- Smithsonian Institution, Washington, D.C.
- University of California, Berkeley.
- University of Kansas.
- University of Minnesota.
- University of Montana.
- University of New York.
- Wilson Ornithological Club.
- Wisconsin Academy of Sciences, Arts and Letters.

## SOUTH AMERICA.

## BRAZIL.

Instituto Oswaldo Cruz.

## URUGUAY.

Instituto de Pesca, Monte Video.

Museo Nacional, Monte Video.

## ASIA.

## CEYLON.

Colombo Museum.

## INDIA.

Agriculture Institute, Pusa,  
Bengal.

Asiatic Society of Bengal.

Board of Scientific Advice for  
India.

Director General, Indian Medical  
Service ('Paludism.')

Geological Survey of India.

Superintendent of Govt. Printing,  
Calcutta.

## JAVA.

Chef van het Mijuwesen.

(see also under Holland.)

## PHILLIPINE ISLANDS.

Bureau of Science, Manila.

Manila Medical Society.

## AUSTRALASIA.

## NEW SOUTH WALES.

Australasian Association for the  
Advancement of Science.

Australian Museum, Sydney.

Botanic Gardens, Sydney.

Department of Agriculture.

Geological Survey of N.S.W.

Linnean Society of N.S.W.

Naturalists' Society of N.S.W.

Observatory, Sydney.

Public Library, Sydney.

Royal Anthropological Society.

Royal Society of N.S.W.

Technological Museum, Sydney.

The University of Sydney.

## NEW ZEALAND.

Auckland Institute.

Dominion Museum, Wellington.

Geological Survey.

New Zealand Institute.

## QUEENSLAND.

Colonial Botanist, Brisbane.

Field Naturalists' Club.

Geological Survey of Queensland.

Public Library, Brisbane.

The Queensland Museum, Brisbane.

The University of Queensland,  
Brisbane.

## SOUTH AUSTRALIA.

Geological Survey.

National Museum, Adelaide.

Public Library, Adelaide.

Observatory, Adelaide.

Royal Geographical Society.

Royal Society of S.A.

The University of Adelaide.

## TASMANIA.

Field Naturalists' Club.

Geological Survey of Tasmania.

Royal Society of Tasmania.

The University of Tasmania.

## VICTORIA.

Australian Institute of Mining  
Engineers.

Department of Agriculture.

Dept. of Fisheries (Common  
wealth).

Department of Mines.

Field Naturalists' Club of Vic-  
toria.

Government Botanist, Melbourne.

National Museum, Melbourne.

Public Library, Melbourne.

Royal Australasian Ornithologists'  
Union.

Royal Geographical Society.

Royal Society of Victoria.

The University of Melbourne.

## WESTERN AUSTRALIA.

Geological Survey of W.A.  
Museum, Perth.

Royal Society of W.A. (late  
Natural History Society).

The University of W.A.

W.A. Astronomical Society.

## EUROPE.

## AUSTRIA.

Astronomische Arbeiten des K.K.  
Gradmessungs-Bureau, Vienna.  
K.K. Geographische Gesellschaft.

## BELGIUM.

Académie Royale de Belgique.  
Institut Solvay, Brussels.  
Jardin Botanique de l'Etat,  
Brussels.  
Société Royale de Botanique de  
Belgique.

## ENGLAND.

British Museum.  
Cambridge Philosophical Society.  
Conchological Society.  
Imperial Institute.  
Linnean Society of London.  
Literary and Philosophical Society,  
Manchester.  
Philosophical and Literary Society,  
Leeds.  
Royal Botanic Garden, Kew.  
Royal Colonial Institute.  
Royal Society of London.

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Naturhistorischer Verein der  
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Verein für Naturkunde zu Cassel.

## HOLLAND.

Koninklyke Naturkundige Vereeni-  
gingin Nederlandsch.  
Technische Hoogeschool, Delft.  
(see also under Java).

## HUNGARY.

Naturwissenschaftliche Verein de  
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## IRELAND.

Royal Irish Academy.

## ITALY.

Accademia Real della Scienza della  
Istituto Bologna.  
Laboratorio di Zoologia Generale  
di Agraria.  
Museo Civico di Storia Naturale,  
Genoa.  
Rassegna Mensile di Botanica  
("Malpighia"), Catania.  
Società Africana d'Italia, Naples.  
Società Toscana di Scienze Naturali,  
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## PORTUGAL.

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Artes, Barcelona.

## SWEDEN.

Geological Institute, Upsala.

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Naturforschende Gesellschaft,  
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## OCEANIA.

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## ERRATA.

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- p. 37, line 34. For "*Heterophyces*" read "*Heterophyes*."  
p. 42, line 5. Delete "Breinl, 1913d; Nicoll."  
p. 45, line 16. Delete "sp." after *Casuariiformes*.  
p. 51, line 16. For "*ryaocephala*" read "*cyancephala*."  
p. 56-60. For *Jnstn.*, 1911f read *Jnstn.*, 1911<sub>4</sub>.  
p. 59, line 20. For "larvae" read "larval."  
p. 67, line 22. For "oliogochaetes" read "oligochaetes."

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## PRESIDENTIAL ADDRESS.

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*Delivered before the Royal Society of Queensland, 27th  
March, 1916.*

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YOUR EXCELLENCY, LADIES AND GENTLEMEN,

I am departing from the usual custom of former presidents of this Society by dividing the annual address into two distinct parts, the first portion being more of the nature of a survey of the Society's affairs and a review of some recent work relating to certain biological problems of importance to Queensland, whilst the second part is offered as a purely scientific contribution under the title "A Census of the Entozoa recorded from Queensland, arranged under their Hosts."

The year 1915 was marked by increased activity of members doing research work and, as a result, more papers were offered than the Society was able to publish, owing to lack of sufficient funds. This led to your Council appointing a small deputation which interviewed the Hon. the Premier and asked for assistance from the Queensland Government. As the request was made just too late for a sum to be placed on the Estimates for the current financial year (1915-1916), the Premier generously offered to print Dr. H. C. Richards' paper on "The Volcanic Rocks of South Eastern Queensland," the expense being borne by the Chief Secretary's Department. This paper would have cost the Society over £40 to print. We, therefore, have reason to express our gratitude to the Government for its timely assistance towards the publication of original research work in this State.

With a view to increasing the interest in our monthly meetings, the Council has revived, with marked success, the practice of exhibiting specimens of note and has also regularly issued to members an abstract of the proceedings of each meeting.

Volume XXVII., Part I. was published in December last, the various numbers constituting it having been distributed earlier, as mentioned in the Part. Part II. has just come to hand.

In order to fill a long felt want, your Council is now engaged in compiling a card catalogue of the serial scientific and technical literature available in the various libraries in Brisbane, and with this end in view, has invited the co-operation of the University, the Queensland Museum, Government Scientific laboratories, the various scientific and professional societies and institutions as well as the public and parliamentary libraries. A number of the institutions have already given the desired information, while several others are now engaged in its compilation. When completed, this catalogue, which, it is hoped, will be eventually printed, should be of great assistance to Queensland workers in science.

In addition to the ordinary meetings at which papers were read, specimens exhibited, etc., there were three occasions during the year when lectures were delivered to the members. His Excellency the Governor gave an interesting address on "Sidelights on South African History within the past thirty years," a subject on which he is well qualified to speak on account of his long official connection with that portion of our Empire. Mr. F. Bridwell, Entomologist to Hawaiian Sugar Planters' Association, gave an account of the work done by parasitic insects in controlling pests of economic importance. Mr. R. J. Tillyard, M.A., B.Sc., delivered a fine lecture on the "Life History of a Dragon Fly," a subject on which he is a recognised authority. To these three gentlemen the thanks of the Society are due.

Nine members were admitted during the year, and there are now 12 corresponding members and 95 life and

ordinary members. Two corresponding and at least two ordinary members are on active service, while some others are engaged in home defence and in munition work.

During the year we suffered the loss of one of our oldest members. Mr. F. Manson Bailey, C.M.G., F.L.S., etc.\* and there also passed away Mr. C. W. DeVis, M.A. who was for a long time a prominent member, and Mr. C. W. Costin, a member for a number of years prior to 1914.

#### FREDERICK MANSON BAILEY, C.M.G., F.L.S., ETC.

Frederick Manson Bailey was born on the 25th March, 1827, at Hackney, London, where his father, John Bailey, was connected with Loddiges' nurseries. At the end of 1838 the latter with his family sailed for South Australia arriving there in the following March. He brought out a number of interesting plants, and soon after landing, at the request of the then Governor, he started to form a Botanic Garden, and was appointed Colonial Botanist. F. M. Bailey assisted his father in this work, and though only twelve years of age at the time, had gained some knowledge of plants from his parent. Hard times affecting the young colony, the work could not be continued, so the Baileys started farming and subsequently opened a plant nursery in Adelaide, F. M. Bailey joining his father in the undertaking, which became noteworthy for the introduction of many plants now grown in that State for commercial purposes. F. M. Bailey, with a thirst for botanical investigation, journeyed to New Zealand in 1858, but, owing to the Maori war, left there in 1861 for New South Wales and came to Queensland in the same year. From this time until his appointment as Colonial Botanist in 1881, he did a good deal of collecting in various parts of the State and contributed articles, principally for newspapers, on plant life generally. His first publication of any note was the "Handbook of Queensland Ferns," issued in 1874. Towards the end of the seventies he acted as

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\* I am indebted to Mr. J. Bailey, Director of the Brisbane Botanic Gardens and Government Botanist, for information supplied to me, regarding his father; and to Mr. Henry Tryon, Government Entomologist, for his generous assistance regarding Mr. C. W. DeVis' obituary notice.

botanist to the Board appointed to inquire into the diseases of live stock and plants, his work in this connection bringing him into touch with the inland parts of the State. He collaborated with the Rev. J. E. Tenison-Woods in bringing out a "Census of the Flora of Brisbane," which was published in the fourth volume (1880) of the Proceedings of the Linnean Society of New South Wales.

About the time of his appointment as Colonial Botanist, he was offered, through the Kew authorities, a position with the Government of India, but having an ambition to work up the flora of Queensland, declined it. Until a few years ago he was an active member of this Society, having held the positions of President (1890-1) and Vice-President (1891-2) and was also a member of the Council from 1883 until 1900. While the Field Naturalists' Section of the Society was in existence, he was one of the most active workers and accompanied the members on numerous excursions. His advancing age prevented him from attending our meetings during the past few years. He was a life member of our Society, and—like the late Mr. C. W. DeVis—a member of its first Council (1883). The first paper published in its Proceedings was Mr. Bailey's "Contributions to the Queensland Flora." (P.R.S. Q'land I., 1884, pp. 8-12.)

As one of the local commissioners appointed by the Queensland Government for the Exhibition held in London in 1886, and in Melbourne in 1888, he arranged for the collection and classification of an exhibit of timbers, the result being that over six hundred kinds were got together. A useful descriptive catalogue from his pen accompanied the exhibit on each occasion. On his advice a duplicate set was prepared and retained in the State and this is now on view in the Botanic Museum at the Brisbane Botanic Gardens.

Owing to his extensive knowledge of horticultural matters, especially in regard to fruit growing, his advice was eagerly sought by those interested in this subject, and many years ago he drew attention to the possibilities of the Stanthorpe district as suitable for production of European fruits. He wrote a number of articles on the

subject, one of which was "A Half Century of Notes for the guidance of Amateur Fruit Growers." In 1896 he represented the Queensland Government at a conference of fruit growers held at Wellington, N.Z., when he contributed a paper on "Queensland Blight Fungi," a subject with which he was well conversant. He paid visits to many parts of the State in connection with his work, one of the most noteworthy being that to the Bellenden Ker Ranges in company with Mr. Archibald Meston in 1889, which resulted in a number of new and interesting species being added to the flora. Another one to the islands of Torres Straits and Cape York in 1897 brought to light additional knowledge of the flora of that portion of the State and formed the subject of a paper read at the Sydney meeting of the Australasian Association for the Advancement of Science, in 1898.

He always had an aversion to interfere with the work of other botanists and this was the reason why he would not describe plants sent to him from New Guinea prior to the death of Baron von Mueller, but forwarded them to that noted scientist who then was the sole Australian worker. Afterwards, however, he contributed, as occasion offered, articles on the flora of that island, in the *Queensland Agricultural Journal*, some of the most interesting of which appear in the August, 1898, and subsequent issues. The material for these was obtained in that year while accompanying Lord Lamington's party on a visit to Sir William McGregor, who was a close friend of the late Mr. F. M. Bailey. A brief account of this trip appears in Volume XIV. of the Proceedings of this Society.

In recognition of his labours in the cause of his beloved subject he was awarded the "Clarke Memorial Medal" in 1902, by the Royal Society of New South Wales, and created a Companion of the Order of St. Michael and St. George, by His Majesty the King, in 1911.

He was president of Section D. (Biology) at the Sydney meeting of the Australasian Association for the Advancement of Science in 1911.

Fellow botanists have attached his name to about fifty species of plants to commemorate his connection with

the Australian flora, e.g., *Acacia baileyana*, F. v. M.; *Samadera baileyana*, F. v. M.; *Indigofera baileyi*, Oliv.; *Eucalyptus baileyana*, F. v. M.; *Cryptandra baileyi*, F. v. M.; *Tecoma baileyana*, Maid. & Baker; *Persea baileyana*, F. v. M.; *Dendrobium baileyi*, F. v. M.; *Bulbophyllum baileyi*, F. v. M.; *Panicum baileyi*, Benth.; *Ditrichium baileyi*, C.M.; *Dicranum baileyi*, C.M.; *Dicronella baileyana*, C.M.; *Trematodon baileyi*, Broth.; *Leucobryum bailey-anum*, C.M.; *Macromitrium baileyi*, Mitt.; *Schelotheimia baileyi*, Broth.; *Distichophyllum baileyana*, C.M.; *Splachnobryum baileyana*, Broth.; *Hookeria baileyi*, Broth.; *Neckera baileyi*, C.M.; *Meteorium baileyi*, Broth.; *Homalia baileyana*, C.M.; *Isopterygium baileyana*, C.M.; *Fabronia baileyana*, C.M.; *Plagiochila baileyana*, Steph.; *Euosmo-lejeunea baileyana*, Steph.; *Eumitria baileyi*, Stirt.; *Ocellularia baileyi*, Mull. Arg.; *Graphus baileyana*, Mull. Arg.; *Helminthocarpum baileyana*, Müll. Arg.; *Parmentaria baileyana*, Mull. Arg.; *Endocarpon baileyi*, Stirt.; *Pyrenula baileyi*, C.K.; *Merulius baileyi*, B. and Br.; *Clavaria baileyi*, Massee; *Cyathus baileyi*, Massee; *Ascobolus baileyi*, B. and Br.; *Nummularia baileyi*, B. and Br.; *Asterina baileyi*, B. and Br.; *Coleochaete baileyi*, Moeb.; *Spirogyra baileyi*, Schmid.; *Alsophila baileyana*, Domin.; *Hymenophyllum baileyana*, Domin.; *Trichomanes baileyana*, Watts; *Asplenium hookerianum baileyana*, Domin.

He was a Fellow of the Linnean Society of London; Associé de la Société Royale de Botanique de Belgique; and Corresponding Member of the Linnean Society of New South Wales, the Royal Society of South Australia, the Royal Society of Tasmania, the Royal Society of Victoria, the Botanical Society of Edinburgh, and the Pharmaceutical Society of Great Britain

He died on 25th June, 1915, at the ripe age of 88, practically in harness, having been engaged in his botanical work up to the time of his final illness, which was a short one. Many of us will miss his kindly smile and his geniality which always awaited his friends when visiting the Herbarium. His willingness to help those interested in our flora is worthy of special mention.

It is a pleasure to us to know that his work is being continued, as far as other departmental duties will allow, by his son, Mr. J. F. Bailey, to whose duties as Director of the Brisbane Botanic Gardens, those of Government Botanist have been added, and in this sphere of labour he is being assisted by the late Mr. F. M. Bailey's grandson, Mr. Cyril T. White.

The late Mr. Bailey's publications are as follows :—

*Trans. Phil. Soc. Q'land*:—

A few remarks on our naturalised Solanums, III, March, 1881, 4 pp.

*Proc. Roy. Soc. Q'land*:—

Contributions to the Queensland Flora, I, (1), 1884, p. 9; I, (2), p. 84; I, (3), 148; A contribution towards the Flora of Mt. Perry, I, (2), 61; Fasciation in *Sicyos argulata* L. I, (2), 102; Fasciation in *Bouvardia*, III, 153; Description of a new species of *Acacia*, V, (3), 1888, 121; Description of a Queensland form of *Nipa fruticans*, V, (4), 146; Note on *Acacia melaleucoides*, V, (4), 148; Concise History of Australian Botany, VIII, (2), xvii; Notes on some plant specimens collected by Dr. T. L. Bancroft on the Diamantina, VIII, (4), 128; Description of a new Eucalypt, X, 1893, 17; Exhibit of a bunya nodule, etc., X, 1894, 53; An account of the Easter excursion . . . to Eumundi, X, 1894, 51; Obituary notice of Dr. C. Prentice, X, 50; Botanic Notes, XI, 1894, 14; Notes on the Vegetation of New Guinea, XIV, 14; Contributions to the Flora of New Guinea, XVIII, 1.

*Government Printer, Brisbane.*

A classified Index of the Indigenous and Naturalised Plants of Queensland, 1883; Synopsis of the Flora of Queensland, 1883-1884; Catalogue of plants in the two Metropolitan Gardens, the Brisbane Botanic Garden and Bowen Park, 1885; Occasional papers on the Queensland Flora, 1886; Suppl. Synopsis of Q'land Flora and Classified Index, 1886; Second supplement, ditto, 1888; Botany of the Bellenden Ker Expedition, 1889; A classified Index of the Indigenous and Naturalised Plants of Queensland, 1889;

Third Suppl. Syn. Q'land Flora, 1890 ; Addenda to Third Suppl., 1890 ; Contributions to the Queensland Flora, Dept. Agric., Bull. 4, 1890 ; Bull. 7, 1891 ; Bull. 9, 1891 ; Bull. 13, 1891, Bull. 18, 1892 ; Lithograms of the Ferns of Queensland, 1892 ; Bull. 20 (Botany Bull. 6) Contrib. Q'land Flora, 1893 ; Companion for the Queensland Student of Plant Life, 1893 ; Second Edition, 1897 ; Bull. 21 (Bot. Bull. 7), 1893 ; Botany Abridged, etc., 1894 ; Bot. Bull. 8, 1893 ; Bot. Bull. 9, 1894 ; Bot. Bull. 10, 1895 ; Additions to Flora of New Guinea, 1895 ; Bot. Bull. 11, 1895 ; Peculiarities of the Queensland Flora. Bot. Bull. 12, 1895, pp. 11-26 ; Bot. Bull. 13, 1896 ; Additions to the New Guinea Flora, 1896 (April and Oct.) ; Bot. Bull. 14, 1896 ; Bot. Bull. 15, 1898 ; Bot. Bull. 16, 1903 ; Bot. Bull. 17, 1913 ; Weeds and suspected poisonous plants of Queensland, 1906 ; The Queensland Flora (6 parts), 1899-1902 ; Comprehensive Catalogue of the Queensland Plants, 1912 ; Official Guide to the Queensland Museum of Economic Botany, 1891 (Govt. Printer, Brisbane).

*Queensland Agricultural Journal*:—

Contributions to the Flora of Queensland and New Guinea, Vol. 1, onwards (1897-1915) ; Plants reputed to be poisonous to Stock (*Colostemma luteum*, etc.), 1, 1897, 328 ; A neglected natural product (The ear fungus—a Chinese soup plant) 2, 1898, 40 ; Plants reputed poisonous to stock (Prickly lettuce, *Lactuca scariola*) 2, 40 ; ditto (Order Cycadaceæ) 2, 131 ; Edible fruits indigenous to Queensland, No. 1. Davidson plum,—No. 2. Endeavour River Pear. 2, 471 ; Indigenous rubber plant (*Excaecaria dallachyana*) 3, 1898, 284 ; Plants reputed poisonous to stock (Noogoora Burr, *Xanthium strumarium*) 3, 356 ; ditto (Redhead or milky cotton bush *Asclepias curassavica*) 3, 437 ; ditto (Hedge nettle *Stachys arvensis*) 4, 1899, 49 ; ditto (*Pratia erecta*) 4, 285 ; ditto (Arsenic plant *Hibbertia bennettii*) 4, 465 ; Economic Botany (The Kei Apple *Aberia caffra*) 4, 468 ; Plants reputed poisonous to Stock (Scarlet blood-root, *Haemodorum coccineum*) 5, 1899, 41-2 ; ditto (Wallflower poison-bush, *Gastrolobium grandiflorum*) 5, 287 ; ditto (the physic nut, *Jatropha cueca*) 6, 1900, 382-3 ; ditto (Leichhardt's Leguminous Ironbark,

*Erythrophloeum labouchei*) 7, 1900, 153; Noxious weeds (yellow water lily, *Nymphaea flava*) 7, 154; ditto (climbing buckwheat, *Polygonum convolvulus*) 7, 441; An abnormal growth in a papaw fruit 7, 442; Plants reputed poisonous to stock (*Sarcostemma australe*) 7, 259; ditto (*Gomphocarpus brasiliensis*) 7, 348; A New Guinea food plant 7, 442; Noxious weeds (Chinese burr, *Triumfetta rhomboidea*) 8, 1901, 111; Stink grass of Brazil (*Melinis minutiflora*) 9, 1901, 215; On the so called African Wonder-grass 21, 1908, 8.

*Ann. Rep. Brit. New Guinea.*

Contributions to the Flora of New Guinea, 1897-8 (1898), 137; Contributions to the Flora of New Guinea, 1899-1900 (1901), p. 133; Account of a New Guinea food plant, p. 134; Contributions to the Flora of Brit. New Guinea, 1900-1 (1902), 142; Names of easily recognised plants observed by Lord Lamington's party during New Guinea trip in Lord Lamington's Report of a visit to Brit. New Guinea—Parliamentary paper, June, 1898, p. 27.

Report by the Government Botanist on Botanical specimens collected by Mr. A. Meston on or about the Bellenden Ker Range, in report by Mr. Meston on the expedition to the Bellenden Ker—Parliamentary paper, March, 1904, p. 9.\*

*Proc. Linn. Soc. N.S. Wales* (1st Series):—

A general account of the Flora of tropical Queensland, II, 276; On the Ferns of Queensland, III, 118; On some of the introduced plants of Queensland, IV, 26; On a new species of fern, *Asplenium prenticei*, IV, 36; Medicinal plants of Queensland, V, 1; On Queensland Ferns with a description of two new species, V, 29; On a new species of *Nepenthes*, V, 185; On the Flora of Stradbroke Island, etc., VI, 139.

*Proc. Roy. Soc. Tasmania.*

Our Grasses (Queensland), 1875 (1876), 127; A few remarks on the distribution and growth of Queensland plants, 1878, 51.

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\* I am indebted to Mr. C. T. White for many of the above references to Mr. Bailey's papers.

*Miscellaneous.*

Queensland Blight Fungi, Notes and Exhibit at Fruit-growers' Conference, Wellington, New Zealand, May, 1896, 8 pages; Handbook of the Queensland Ferns, Brisbane, 1874; The Fern World of Australia, with names of the Queensland species, etc., Brisbane, 1881; The Flora of Queensland, Colonial and Indian Exhibition, London, 1886; a few Queensland grasses, etc.; Queensland woods, etc.; a sketch of the Economic Plants of Queensland; —Queensland Commission—Colonial and Indian Exhibition, London, 1886; 2nd Ed., Melbourne Exhibition, 1888; 3rd Edit., Greater Britain Exhibition, London, 1899.

*Rep. Austr. Assoc. Adv. Science.*

A review of the Fungus blights which have been observed to injure living vegetation in the Colony of Queensland, IV, 1892 (1893), p. 388; Peculiarities of the Phanerogamic Flora of Q'land, VI, 1895, p. 389; A few words about the flora of the islands of Torres Straits, etc., VII, 1898, p. 423.

*F. M. Bailey and P. R. Gordon—*

Plants poisonous to stock—Govt. Printer, Brisbane, 1887.

*F. M. Bailey and K. T. Staiger—*

An illustrated Monograph of the Grasses of Queensland—Brisbane, 1879.

*F. M. Bailey and J. E. Tenison-Woods—*

A census of the Flora of Brisbane, P.L.S., N.S.W., Ser. 1., IV, 137; On some of the Fungi of N.S.W. and Queensland, *l.c.*, V, 50.

## C. W. DeVis, M.A.

Mr. Charles Walter Devis or DeVis (born 9th May, 1829; died 30th April, 1915—aged 86 years) was a scientific worker who, like Mr. Bailey, was especially identified with the founding and development of this Royal Society. He was a member of its first Council and eventually became

President. He was also a very important contributor to our Proceedings, as can be seen by a glance at the list of his published work.

He was a son of James Devis, of Birmingham, and a relative of the well known portrait painters, Arthur and Arthur William Devis, father and son, who flourished in the 18th and 19th centuries. His early education was received at Edward VI's Grammar School, Birmingham, whence he proceeded to Magdalen College, Cambridge, graduating B.A. He did not take the degree of M.A. until many years afterwards. He entered the Church of England and was ordained, becoming rector of Brecon, in Somersetshire. Later, his enthusiasm for natural history led him to accept the position of Curator of the Queen's Park Museum, Rockvale, Manchester, and while there he actively interested himself in Anthropology, becoming a vice-president of the newly formed Anthropological Society. It was about this time that his earliest papers, of which I have a record, were published (1865-1870).

In June, 1870, he left for Australia, arriving in Rockhampton in November of that year, and eventually settling at Black Gin Creek, near that City, and, later, in the Clermont district. Subsequently he revisited England. On his return to Rockhampton he became the librarian of its School of Arts. During this time he contributed a number of articles on the local bird-life and geology to the *Queenslander* under the pen-name of "Thickthorn."

In January, 1882, he came to Brisbane to take up the Curatorship, afterwards designated Directorship, of the Queensland Museum in succession—after a long interregnum—to Dr. W. A. Haswell, now Professor of Biology in Sydney University. This position he occupied for nearly twenty-three years, retiring on account of age in 1905, though his services were retained as a consulting specialist until three years before his death.

In estimating the value of Mr. DeVis' work at the Museum, one must take into consideration the smallness of the staff and of the annual vote for the upkeep of the institution at the time. He did a great deal of classifica-

tion work, added very considerably to the collections, and built up a fine library. He also did much to explore and make known the post-pliocene bone deposits of this and other States.

One feature of the mineral collection, as arranged by him, deserves mention, viz.: the arrangement of the ores and their country rocks according to their local occurrence. This collection was duplicated and then forwarded to the Indian and Colonial Exhibition in London and served as an advertisement of the mineral resources of Queensland. He also arranged the magnificent collection of specimens relating to the natives of British New Guinea, got together and forwarded by Sir William MacGregor while administrator of the territory.

Owing to extreme congestion, it was found necessary to remove the Museum from William St. (Public Library Building) to its present position (Exhibition Building, Bowen Park), Mr. DeVis superintending the removal and rehabilitation.

It was during his tenure of office that the publication of the Annals of the Queensland Museum was commenced.

As already mentioned, he was a member of our Council from 1884 until 1894, vice-president in 1884-5 and 1886-7, becoming President in 1888-9. In 1882 he was elected a corresponding member of the Linnean Society of N.S.W.; in 1888 a vice-president of the Australasian Association for the Advancement of Science at its first meeting in Sydney, while in 1893 he became president of section D (Biology) at the Adelaide meeting. He was also a member of the "Vernacular Names for Australian Birds" Committee, assisting in the drafting of the final report. He was also a member of the committee for the scientific exploration of the islets of the Great Barrier Reef, but owing to lack of funds the Committee lapsed. In 1900 he was elected an Honorary Member of the Royal Geographical Society of Australasia, Queensland Branch; and in 1901 was appointed a vice-president of the Australian Ornithologists' Union. He was also a member of the British Ornithologists' Union.

He was one of the local commissioners to the International Exhibition held in Melbourne in 1888, as well as to Indian and Colonial Exhibition in London in 1886.

In regard to Mr. DeVis' scientific work, it may be mentioned that about forty papers were published by him in the Proceedings of this Society, between 1884 and 1894. Whilst Sir William MacGregor was Administrator of British New Guinea, Mr. DeVis furnished him with eight reports on the avian and reptilian fauna and anthropology, based on collections made under the auspices of the Lieutenant Governor. These were printed in the latter's Annual Reports for the Territory, 1884-1894, and have, in some instances, been reprinted by the Colonial Office and the British Ornithologists' Union.

He was an active Corresponding Member of the Linnean Society of N.S.W. and published nearly forty papers in its Proceedings.

As one might have expected, the Annals of the Queensland Museum contain many contributions from his pen.

At the time of his death, Mr. DeVis was engaged upon a comparative vocabulary of the Australian race, a compilation drawn from numerous sources. Mr. Tryon informs me that he believes that the manuscript has, in compliance with Mr. DeVis' request, been handed over to the Queensland Department for the Protection of Aborigines.

Mr. DeVis' reputation as a scientific investigator rests chiefly on his work on the vertebrate fossils of Australian post-tertiary deposits. He, however, carried out a great deal of systematic work on recent mammals, birds, reptiles and fish, and besides was also interested in Anthropology, and published a few small papers on Papuan ethnology.

The following is a list of Mr. DeVis' published papers:—

Ornithological Notes from Manchester. Zoologist 23, 1865, pp. 9596-7; Notes on the Myology of *Viverra civetta*, Journal of Anatomy and Physiology, 2, 1868, pp. 207-217; Elasticity of Animal type, Anthropol. Soc. Mem. 3, 1870, pp. 81-105. These three were published prior to his arrival in Australia.

*Proc. Roy. Soc., Queensland.*

The Moa (*Dinornis*) in Australia I, (1) 1884, 23 ; On *Ceratodus*, post-pliocene I, (1), 40 ; On new Australian lizards I, (2), 1884, 53 ; On a new form of the genus *Therappon* I, (2), 56 ; On new Queensland lizards I, (2), 77 ; On new species of Australian lizards I, (2), 97 ; On a new species of *Hoplocephalus* I, (2), 100 ; Notes I, (2)—On an anomalous snake, p. 58, a possible source of isinglass, p. 58 ; nest of *Philemon corniculatus*, p. 58, deglutition in the freshwater snake, p. 82, *Perameles bougainvillii*, p. 101 ; On apparently new species of *Halmaturus* I, (3), 1884, 107 ; On new species of *Hyla* I, (3), 128 : Descriptions of new snakes with a synopsis of the genus *Hoplocephalus* I, (3), 138 ; On new fish from Moreton Bay I, (3), 144 ; Notes on the fauna of the Gulf of Carpentaria I, (3), 154 ; A conspect of the genus *Heteropus* I, (4), 1885, 166 ; Notes on a whale *Ziphius layardi* recently stranded near Southport I, 4, p. 174 ; On bones and teeth of a large extinct lizard II, (1), 1885, 25 ; Description of a species of *Eleotris* from Rockhampton II, (1), 32 ; On an extinct monotreme, *Ornithorhynchus agilis* II, (1), 35 ; On a lizard and three species of *Salarias* II, (1), 56 ; Notice of a fish apparently undescribed II, (2), 1886, 144 ; On a fossil saurian II, (2), 181 ; Notice of a probable new species of *Dendrolagus* III, 1887, 11 ; A post-pliocene artiodactyle III, 42 ; On a femur probably of *Thylacoleo* III, 122 ; Notes (various) III, 31, 142 ; On an extinct Mammal of a genus apparently new (*Owenia*) IV, 1887, 99 ; On a third species of the Australian tree kangaroo IV, 132 ; On *Diprotodon minor* V, (2), 1888, 38 ; On the genera *Nothotherium* and *Zygomaturus* V, (3), 111 ; Australian Ancestry of the Crowned Pigeon of New Guinea V, (4), 127 ; On an extinct genus of mammals V, (5), 1889, 158 ; On a naked-eyed skink apparently new V, (5), 160 ; *Colluricincla sibilis*, n. sp. V, (5), 161 ; Additions to the list of fossil birds VI, (1), 1889, 55 ; On *Megalania* and its allies VI, 93 ; On the Phalangistidæ of the post-tertiary period on Queensland VI, 105 ; Exhibit of fossil bones VI, 126 ; On a bone of an extinct eagle VI, 161 ; Description of new birds from Herberton VI, (5), 242 ; A further account of *Prionodura newtoniana* VI, (5), 245 ; A new *Acanthiza* from Herberton VI, (5),

248 ; List of birds, lizards and snakes collected at Cambridge Gulf (by Saville Kent) VI, (5), 236 ; Descriptions of two new vertebrates in Mr. Saville Kent's collection VI, (5), 237 ; The Ribbon fish VIII, (4), 1892, 109 : The lesser Chelonians of the Nototherian drifts X, 1894, 123 ; On the mandible of *Zygomaturus* XI, (1), 1895, 5.

*Annals of the Queensland Museum :—*

Zoology of British New Guinea—vertebrate, 2, 1892 ; The extinct freshwater turtles of Queensland, 3, 1897 ; Occasional notes :—A Papuan Kite ; A further trace of an extinct lizard ; Bones and diet of *Thylacoleo* ; Description of a *Charmosinopsis* ; A new species of hairy-nosed wombat, 5, 1900, 16 pp. ; A contribution to the knowledge of the extinct avifauna of Australia, 6 (date ?), 3 ; Fossil vertebrates from New Guinea 6, 26 ; Papuan charms 6, 32 ; Bats, 6, 36 ; Ornithological (Notes) 6, 41 : Reptilia—A new genus of lizards, etc. 6, 46 ; Fossils from the Gulf watershed 7, 1907, 3 ; an eccentric rat, 7, 8 ; A New Guinea tree rat 7, 10 ; A Papuan relic 7, 12 ; On some Mesozoic Fossils, 10, 1911, 1 ; Annelid Trails, 10, 12 ; *Palæolestes gorei*, n. sp., an extinct bird, 10, 15 ; Cestraciontidæ, 10, 18 ; A wild dog from British New Guinea 10, 19 ; Description of Snakes apparently new, 10, 21 ; A second species of *Enoplosus*, 10, 29 ; A fisherman's spider, 19, 167.

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*New Zealand Journal of Science.*

The Moa in Australia (2), 1, 1891, pp. 97-101.

*Annual Report on British New Guinea.*

Report on Reptiles of B.N. Guinea, 1888-9, p. 62 ; Report on Birds, 1888-9, p. 57 ; Report on Zoology, 1889-90, p. 107 ; Report on the Zoological Gleanings of the Administration during the year 1890-1 (1892), p. 93 ; Report on Ornithological specimens collected in Brit. New Guinea, 1893-4, p. 99\* ; Report on Ethnological specimens, etc.,

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\* Also in Blue Book, 1894, p. 1, *vide* Zoological Record, 1894. Aves, p. 6.

1893-4, p. 98 ; Report on a recent Anthropological collections, New Guinea, 1895-6, p. 91 ; Report on the Birds of New Guinea, 1896-7, Appendix AA., p. 81.

*Proc. Q'land Branch, Roy. Geogr. Soc. Austr.*

On the word "Kangaroo" X, 1894-5, p. 35.

*Miscellaneous.*

Zoology of Bellenden-Ker as ascertained by the late expedition under Mr. A. Meston, in report of the Govt. Scientific Expedition to Bellenden-Ker Range, etc., Govt. Printer, Brisbane, 1889. Reptiles of New Guinea, in J. P. Thomson's British New Guinea, 1892 (Brisbane), p. 273.

*Report of the Australasian Association for the Advancement of Science.*

Presidential Address—"Life" V, 1893 (1894), p. 104.

*The Ibis.*

Report on birds from New Guinea (Appendix to Ann. Report Brit. New Guinea, 1889) reprinted in Ibis, 1891, p. 25 ; Thirty-six new or little known birds from British New Guinea, 1897, p. 371 ; Description of a new Paradise bird from British New Guinea, 1897, p. 250.

*Proc. Roy. Soc. Victoria.*

Remarks on a fossil implement and bones of an extinct Kangaroo XII (N.S.), 1899, p. 81 ; On some remains of marsupials from Lake Colongulac, Victoria, XII, 107.

CHARLES WILLIAM COSTIN.

The late Mr. Charles William Costin, Clerk of Parliament and of the Legislative Council, died from pneumonia on 13th September, 1915, at the age of 55. He was a member of the Royal Society for a number of years, but resigned towards the end of 1914. Though not a contributor to the Proceedings, he took a keen interest in the work of the Society. For a time he followed journalism, but eventually he was appointed to the *Hansard* staff. From 1884 to 1896 he was third Clerk of the Legislative Council, and in 1896 he was made Clerk Assistant and Usher of the Black

Rod. The latter post he held till 1908. He was a member of various other societies and was actively interested in all public matters.

I think that this is an appropriate occasion to refer to the loss to science caused by the death of Dr. T. S. Hall, M.A., D.Sc., Lecturer in Biology in the University of Melbourne, and a prominent member of the Royal Society of Victoria. He ranked as a world-wide authority on the Graptolites and by his death Australia has lost one of her foremost palæontologists.

It is our privilege to congratulate three of our corresponding members on winning laurels in 1915—Professor T. W. E. David, C.M.G., B.A., D.Sc., F.R.S., of Sydney University, on his being awarded the Wollaston Medal of the Geological Society of London in recognition of his work on Antarctic and Australian geology; Mr. J. H. Maiden, Director of the Botanic Gardens, Sydney, firstly on his election as a Fellow of the Royal Society (London), and secondly on his gaining the Linnean Medal of the Linnean Society of London for his valuable work on Australian botany; and also Prof. J. A. Pollock, D.Sc., of Sydney University, on his election as a Fellow of the Royal Society (London).

One of our members, H. C. Richards, lecturer in geology in the University of Queensland, was awarded the degree of D.Sc., by the Melbourne University for his thesis on the volcanic rocks of South Eastern Queensland, which has just been published by this Society. His investigation has extended over several years and has added considerably to our knowledge of the geology of this State.

*Walter and Eliza Hall Fellowships.*

The trustees of the Walter and Eliza Hall Trust have established certain fellowships in the University of Queensland and these, it is hoped, will be the means of enabling research work of a high order to be carried out in this State. They will be an enduring monument to the names of the two generous donors who have bequeathed their wealth in such a way as to benefit educational and other institutions in Eastern Australia. It is to be hoped that

the example set may lead others in our State to render similar service. Our University has so far received comparatively little in the way of private endowments.

The trustees have founded fellowships in engineering, economic biology and pure chemistry, and a school of applied chemistry, the appointments being made by the Senate of our University subject to the consent of the Trustees of the fund.

Mr. L. S. Bagster, B.Sc., a member of this Society, has been appointed to control the School of Applied Chemistry which will be a branch of the department of Chemistry. He has spent some time in Europe and America gaining experience in applied chemical science. His enquiries abroad have led him to believe that the methods of training as applied chemists adopted by the American Universities and Technical Institutes are more suitable for Australian conditions than those of the English and German institutions. The American schools aim at producing an individual who can respond to the demands of any industry which may need his assistance, rather than one who has been trained for work in one or two industries only. Such a man should not only be a chemist but also an engineer and a man possessing a knowledge of business principles, though of course one could not expect him to be an expert in all these directions. The Senate of the Queensland University propose to include in the curriculum for the degree of Bachelor of Applied Science, full courses in pure chemistry, a special course in the principles of engineering, and a special course in the general principles upon which industrial processes are based, rather than specialised courses in any specific process such as the chemistry of brewing, dyeing, tanning, etc. A graduate from the school should be able, not only to decide upon the possibilities of any suggested scheme, but also to discover and initiate for himself. He should be able, as well, to plan and equip the necessary plant.

Such a school, which is the first of its kind in Australia, should be of material benefit to the community in furthering our industrial development.\*

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\* I am indebted to Mr. Bagster for the above details regarding the School of Applied Chemistry.

The fellowship in pure chemistry has been awarded to Dr. H. G. Denham, one of our former members, while that in economic biology has been allotted to me. It is my intention to continue my work on Australian parasitology, giving more especial attention to the parasitic organisms affecting stock and other domesticated animals in Queensland.

The fellowship in engineering is granted to a graduate in Engineering in our University, who must, during the first two years of its tenure, travel abroad and carry out work either in technical manufacturing works or engineering research laboratories, or else in connection with special engineering enterprise; while during his third year he must assist in teaching and demonstrating in the Engineering school of the University.

*The Commonwealth Government and Applied Science.*

The Commonwealth Government has interested itself in industrial and scientific research and is now considering, in conjunction with the State Government, the appointment of a highly trained entomologist who shall be specially qualified to deal with the insect pests of the sugar cane. This is a matter of importance to Queensland. It has also assisted several workers who are investigating the problem of worm nodules in Australian cattle.

Moreover the Prime Minister now proposes to establish a *Commonwealth Bureau of Science and Industry*. An advisory committee, consisting of scientific and business men, has been formed to assist the Government in formulating a scheme and has recommended that the functions of the Institute should be, amongst other things, "to consider and initiate scientific researches in connection with, or for the promotion of, primary or secondary industries in the Commonwealth"; "the establishment of national laboratories"; . . . "the immediate utilisation of existing institutions, whether Federal or State, for the purposes of industrial scientific research"; . . . "the establishment and award of industrial research studentships and fellowships . . ."; "to draw attention to any new industries which might be profitably established in the Commonwealth" . . .; "the co-ordination and

direction of scientific investigation and of research and experimental work with a view to the prevention of undesirable overlapping of effort" . . . "to recommend grants by the Commonwealth Government in aid of pure scientific research in existing institutions"; etc. It is also recommended that the Institute should be controlled by a small directorate consisting of a capable business man and two highly qualified scientists.

Amongst the problems calling for early attention are many of a chemical nature, while a few are biological, *e.g.*, the control of the sheep fly pest, the eradication of prickly pear, and the re-establishment of saltbushes and allied fodder plants.

### *The National Park.*

Towards the end of 1915, the Government of this State, to its credit, proclaimed as a national park a large area, comprising about 47,000 acres, situated in south-eastern Queensland, contiguous with New South Wales and including the scenic Lamington Plateau. In order that this fine tract of mountainous country, which is about 60 miles from Brisbane, might be more than a mere reserve, the Queensland branch of the Royal Geographical Society initiated a movement to stimulate public interest in the matter and the co-operation of the Royal Society and of other bodies was sought.

Representatives met in conference and agreed that joint action should be taken and, as a result, a public meeting was called in order to elect members of a delegation (including a nominee of our Society), to interview the Hon. the Minister for Lands and offer its services in an advisory capacity on matters connected with the control and development of the Park.

With reference to scientific work within the State, other than that connected with our Society, I might mention that the Queensland Museum is still continuing its good work. Last year volume 4 of its *Memoirs* was published and volume 5 is expected within the next few weeks.

The Geological Survey is now publishing not only routine and economic work, such as mining reports, but also purely scientific work.

A recent memoir, which was issued at the end of 1915, contains a report on our Mesozoic flora by our Hon. Secretary, Mr. Walkom, who is still engaged in its study; whilst one just issued contains Mr. R. J. Tillyard's account of the Mesozoic and Tertiary insect remains discovered by the Government Geologist, Mr. Dunstan.

The members of the staff of the Australian Institute of Tropical Medicine, Townsville, North Queensland, are continuing their investigations in regard to disease, parasites, mosquitoes, biting flies, etc., a number of reports having appeared in various publications during the year.

Before concluding this, the first portion of my address, I think it appropriate that I should refer to recent work regarding two biological problems of outstanding importance to this State, viz., the eradication of prickly pear and the control of the parasite, *Onchocerca gibsoni*, Cleland and Johnston, which produces "worm-nodules" or "worm-nests" (worm fibromata) in such a large percentage of our cattle and thereby causes great loss to the meat producing industry. As you are aware, I have been actively interested in both of these matters.

#### THE ERADICATION OF PRICKLY PEAR.

The various species of prickly pear, *Opuntia* spp., cover huge tracts of territory in this State as well as in New South Wales. The most important, because the most abundant, is the common pest pear *Opuntia inermis* var., and its more spiny variety (or perhaps related species) which we may term the Burnett Prickly Pear, as it is particularly prevalent in certain portions of the valley of that river, though it occurs also elsewhere in this State. Probably the most widely distributed species in Australia is *O. monacantha*.

Some years ago the Queensland Government established an experimental station at Dulacca, in the heart of one of the infested districts and placed it under the control of one of our members, Dr. Jean White-Haney,

who has been steadily experimenting with a view to determining the most efficient method of destroying the pest by chemical means. In estimating the question of efficiency it has been necessary to take into consideration various factors such as the cost of labour and material; the method of application of the poisons, whether as infectious in a liquid or solid form or as sprays; the time of the year; the effect of rainfall just prior to or just after treatment; the advantage (if any) of chopping down the pear in order to facilitate the action of the poison, etc. The record of the work done has been published in the Annual Reports of the Department of Public Lands for 1912, 1913 and 1914, and one is now in course of preparation for 1915.

The object aimed at is the complete destruction of the plant, not merely the death of the above-ground portion of it, as the "bulb" is apt to retain its vitality. The chief result of the work has been the discovery that solutions of arsenic pentoxide are much more efficient as a prickly pear poison, than any other known chemicals, and no doubt when a supply of this compound becomes available it will supersede the well known "Brünnich preparation," consisting of arsenic trioxide and caustic soda, which is at present in common use for this purpose.

Her work is summarised in the Annual Report of the Department of Public Lands 1914 (1915), p. 80, and may be briefly summed up as follows:—Arsenic pentoxide is the most effective poison yet used, whether employed in the form of a spray, solid injection or liquid injection, whilst the best result obtained by using gaseous specifics, is produced by the vapours of arsenic trichloride. It was also found that summer and early autumn are the best seasons for applying poisons in any of the forms mentioned, and, moreover, the success of the operation is largely dependent on the fall of rain just before or just after poisoning, probably more especially the former.

We congratulate Dr. White-Haney on her success.

It will be remembered that the Government commissioned Mr. Henry Tryon, Government Entomologist, and myself to visit various countries where prickly pear occurred either indigenously or as naturalised weeds in

order to ascertain, amongst other things, whether there existed in those regions any natural enemies, either plant or animal, which were holding the cacti in check and which might be safely introduced into Queensland with a view to controlling the spread of prickly pear here without themselves becoming a danger to other plant or animal life in this State. As a result of our inquiry it was found that there occurred in certain countries, *e.g.*, Ceylon, India, United States and Argentina, formidable enemies capable of retarding the spread of, and in some cases actually exterminating, certain species of Cactaceæ, and that many of these were restricted in their dietary to this family of plants, sometimes even to one or two species of *Opuntia*.

An account of the work of these organisms is contained in our report\*, but I intend in this brief survey, to refer only to such as were brought, or sent, by us to Australia.

The parasitic fungus *Gloeosporium lunatum*, E. & E., which under certain conditions of climate causes a "shot hole" effect but which in moist warm weather produces a widespread rotting or "black rot" of the young cladodia or "joints," was introduced in the form of cultures, but the attempt to establish it in our State was unsuccessful.

The insect enemies introduced comprised two forms of a wild cochineal, *Coccus indicus*, Green, from India and Ceylon, *C. confusus* var. *capensis*, Green, from Cape Colony and a moth, *Zophodia cactorum*, Berg., from Argentina. The last named failed to establish itself as the larvae which reached Brisbane died before pupating.

The wild cochineal insects, especially the more destructive species, *C. indicus*, have become well established, the latter having been liberated in the vicinity of Bowen and Charters Towers in Northern Queensland, where *Opuntia monacantha* is prevalent†. It is gratifying to

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\* T. H. Johnston and H. Tryon. Report of the Prickly Pear Traveling Commission, Nov. 1912—April 1914. Govt. Printer, Brisbane, 1914.

† J. White-Haney *loc. cit.*, 1914 (1915), p. 82. See also article "Destruction of Prickly Pear by the Cochineal Insect," Q'land Agri. Jour. 4, 1915, p. 323.

know that this parasite is accomplishing in those parts of the State all that was claimed for it\*. We stated† that it had controlled the growth of *O. monacantha* in India and Ceylon to such an extent as to have practically exterminated it, and would no doubt do the same in Queensland; but that it had not attacked, either naturally or under experimental conditions, the species (*O. dillenii*) now prevalent in certain parts of those countries‡ and would not be likely to attack our common pest pear or the Burnett prickly pear. That our views were correct, has since been proved§.

It may be of interest to members of this Society to know that the wild cochineal insects *Coccus indicus*, left by the Commission whilst in South Africa, have become established there and are destroying *O. monacantha* just as they are doing in Queensland, but do not apply themselves to the commonest pest pear of the Cape Province.||

The introduction of a number of other more or less destructive insect enemies of prickly pear was recommended, but this has not, as yet, been authorised.

The Commission also considered that exhaustive experiments should be carried out to test the value of our naturalised *Opuntias* as material for supplementing the various stock fodders now in use, which have a higher nutritive ratio.

The Department of Agriculture has initiated tests in this direction, the work being under the control of one of our members, Mr. F. Smith, B.Sc., of the Agricultural Chemist's Branch.

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\* Johnston and Tryon, *l.c.*, 1914, p. 17.

† *l.c.*, p. 3, 14, sqq.

‡ Johnston and Tryon, *l.c.*, p. 6, 7, 17. See also abstract from Ann. Rep. Director Agric., Ceylon, for 1914, in *Tropical Agriculturist*, Ceylon, Sept., 1915, and in *Q'land Agri. Jour.*, 4, 1915, p. 323.

§ Dr. J. White-Haney, *l.c.*, 1913 (1914), p. 73; 1914 (1915), p. 82.

|| Johnston and Tryon, *l.c.*, p. 34.

Warren, *S. African Agr. Jour.*, 7, 1914, pp 387-391; and abstract in *Review of Applied Entomology*, Ser. A., 2, (7), July, 1914, p. 440; also later references by Mr. Lounsbury and others.

## WORM-NESTS IN CATTLE.

In 1911 I read before this Society\* a summary of the information available regarding Onchocerciasis in cattle. Since then, a few important papers have been published relating to this condition in Australian oxen.

Mr. C. J. Pound† (1911) failed to find larvae in the circulating blood by day or by night, and his attempts at direct infection were unsuccessful. He found the adult parasite in a sheep.

In 1912, my former colleague, Dr. J. B. Cleland‡ discovered the presence of the parasite in nodules in calves which had been born and reared on Milson Island in the Hawkesbury River, N.S.W., not far from Sydney, this showing that "it is therefore practically certain that infection occurred on the island itself and, further, it is obvious that the source of infection must have been some of the older cows or other cattle with which the island was originally stocked" §. He discovered the possibilities of various insects acting as transmitting agents and inclined strongly to the view that, whilst mosquitoes, tabanids, sand flies, etc., could not be absolutely excluded, yet it was quite likely that true cattle-lice (*Haematopinus* spp.) or *Stomoxys calcitrans*, particularly the latter, is the vector. He also reviewed the various possible modes of transmission of the filarial embryos (p. 140).

S. G. Thorn in 1912|| mentioned that he had failed to infect various freshwater organisms with *Onchocerca* larvae.

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\* T. H. Johnston. "On the Occurrence of Worm Nodules in Cattle—a summary." P.R.S., Queensland, 23, 1911, pp. 207-231.

† C. J. Pound in Ann. Rep. Dep. Agr. 1910-11 (1911), p. 67.

‡ J. B. Cleland. "Some Notes and Suggestions in connection with the Etiology of Bovine Onchocerciasis." Austr. Med. Gazette, 1912, p. 4; and "Observations on the Mode of Dissemination of *Onchocerca gibsoni*," in second report Govt. Bureau of Microbiology, Sydney, 1912, pp. 138-141, prefaced by "Remarks on the problem of the dissemination of *Onchocerca*," by Dr. F. Tidswell, L.c., pp. 137-8.

§ Dr. Tidswell (L.c., p. 137) has shown that the original stock had not been exposed to infection from other sources for a period of five years, 1906-1911.

|| Rep. Govt. Bacteriologist—Dept. Agr. Stock. Ann. Rep., 1911-12 (1912), p. 88.

Prof. J. Gilruth and Dr. G. Sweet\*, as a result of experiment, were led to state (p. 29) that "one may infer that neither direct contact nor apparently the intermediation of *Hæmotapinus vituli* or *H. eurysternus* . . . can act as a means of transmission" of the parasite; and believed the intermediate host to be a fly. They brought forward evidence which appeared to support the view that the *Onchocerca* was introduced into Australia long ago in Indian oxen. They mentioned that it is still met with in cross-bred descendents of Brahma cattle in the Northern Territory and that the nodules occur in Javanese bovines (p. 25). The probability of infection taking place during the first few years of the calf's life was restated, mention being made of the facts that there is little, if any, reinfection afterwards and that there is a tendency for the nodules to diminish in size and eventually disappear.

Dr. A. Breinl† published in 1913 an account of part of the anatomy of the parasite and of experiments to determine the life history. He endeavoured to determine whether the larvæ could escape from the capsule surrounding the parent and penetrate the skin of the host and found them in scrapings of the surface in five out of nearly one hundred experiments, the positive results being obtained on hot, rainy days. He, however, states that "the finding of *Onchocerca* larvæ on the outer skin over nodules is of too rare occurrence to be taken into consideration, and may only represent a pathological curiosity, especially as the larvæ belong morphologically to the group which seem to require an insect as intermediary host similar to *Filaria bancrofti* and not to the group of *Filaria medinensis* which are able to live and move in water."

He was unable to infect the stable fly *Stomoxys calcitrans*, various mosquitoes, and the Australian leech *Hirudo*

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\* J. A. Gilruth and G. Sweet. Further observations on *Onchocerca gibsoni*, the cause of the worm nodules in cattle. P.R.S., Vict., 25, 1912, pp. 23-30.

† Investigations into the Morphology and life history of *Onchocerca gibsoni*. Rep. Austr. Instit. Trop. Medicine for 1911 (April, 1913), pp. 5-17.

*medicinalis* (i.e., *Limnobdella australis*) as well as the common *Cyclops* (*C. pallidus*, Breinl) of the swamps near Townsville.\*

Dr. J. B. Cleland† has continued his investigations into the life history of the parasite, his results being published in 1914. He gives a detailed account of a large number of experiments. The conclusions at which he arrived were that various Muscid flies and mosquitoes could ingest the embryos of *Onchocerca* when given access to a recently cut nodule; and that in the case of *Stomoxys calcitrans* these embryos so ingested, were able to remain alive and active within the fly for about three days, whereas in *Musca domestica* and *Musca vetustissima* they were not found alive in the alimentary canal 24 hours after ingestion. He discovered just below the skin of the belly of a calf, a thickened area containing numerous embryos, at a distance from the surface which was often less than the length of the proboscis of *Stomoxys*. He also found in five other animals, embryos in subcutaneous tissues at a distance from the nearest worm-nodule.

His finding of a group of parasites, both males and females, loosely coiled near the hip joint and also a young worm partly imbedded in a lymphatic gland led him to suggest that perhaps an early stage in the life history may be passed within such a gland, from which the parasite eventually may escape into some other tissue. He also discovered *Onchocerca* nodules in a sheep on Milson Island, Hawkesbury River, N.S.W.

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\* On p. 16 of his paper, Dr. Breinl mentions having failed to find microfilariæ during a careful examination of the intestinal contents of about sixty Tabanid flies collected from a locality where nodules were common. It might be pointed out that the larvae, if present, would more probably be in some other part of the body, e.g., muscles or proboscis, as they would soon penetrate the intestinal wall as other filarial embryos do.

† J. B. Cleland. Further Investigations into the etiology of worm nests in Cattle due to *Onchocerca gibsoni*. Bulletin Commonwealth of Australia, Dept. Trade and Customs, 1914—also published under the same title in the Third Report Govt. Bureau of Microbiology, N.S.W. 1912 (1914), pp. 135-153.

Dr. Nicoll\* of the Australian Institute of Tropical Medicine, Townsville, carried out a series of experiments which showed that the embryos do escape through the capsule of the nodule into the adjacent tissues and can eventually reach the surface of the skin, usually in small numbers but sometimes in greater quantity. He believes that a biting or blood-sucking insect is much more likely to be the transmitting agent than any aquatic organism.

McEachran and Hill† have given attention to this problem in the Northern Territory and as a result of their investigations, recorded that practically every bovine there, no matter of what breed, except the buffalo, was parasitised by *Onchocerca*. They experimented with various arthropods, e.g., Tabanidæ, Muscidæ, midges, mosquitoes, lice, and a tick, and came to the conclusion that apparently "the intermediary host is not a biting fly or flying insect," and moreover that lice may also be excluded.

During last year (1915) Dr. G. Sweet‡ published the results of her investigations in other parts of the world, and in her summary (p. 30, *sqq.*) has given a list of the species of *Onchocerca* and allied parasites occurring in various countries in the connective tissues and aortic walls of species of oxen, buffaloes, etc. She also recorded the presence of a new species, *O. indica*, Sweet, from Indian cattle, closely allied to the Australian *Onchocerca*, whose original home appears to have been the Malay Peninsula where it occurs in *Bos indicus*. It is found in this host in Siam and Java also, and, in the latter country, occurs in the common ox, *Bos taurus*, as well.

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\* W Nicoll "On the migration of the larvæ of *Onchocerca gibsoni* through the capsule of the worm nodule." Ann. Trop. Med. and Parasitology, 8, 1914, pp. 609-621—Summarised in his paper "Remarks on the Worm Parasites of Tropical Queensland" Med. Jour. Austr., Sept., 12, 1914.

† J. F. McEachran and G. F. Hill. Investigations into the cause of Worm-nodules (*Onchocerca gibsoni*) in Cattle at Darwin, Northern Territory, Australia. Bulletin of Dept. Trade and Customs, Commonwealth of Australia, 1915.

‡ G. Sweet. Investigations into the occurrence of Onchocerciasis in cattle and associated animals in countries other than Australia. Bull. Dept. Trade and Customs, Commonw. Austr., 1915.

From the summary that I have given, it will be seen that the life history of *O. gibsoni* is still unknown and there is little, as yet, to indicate in what direction we should look for the transmitting agent. Probability still favours a biting fly, as I pointed out in 1911, though McEachran and Hill's evidence is opposed to such a view.

The most important additions to our knowledge in this connection are (1) the presence of embryos just below the skin (Cleland); and (2) the fact that they can and do escape through the skin when the latter is intact (Nicoll).

In Breinl's experiments there was a possibility of injury to the overlying skin being caused by scraping and thus allowing the embryos to escape.

Until we know the transmitting agent we cannot hope to control the parasite.

In concluding this portion of my address, I take the opportunity to express my appreciation of the work done by our Hon. Secretary and Editor, Mr. A. B. Walkom, B.Sc. The thanks of the Society are due to him for efficient services ungrudgingly rendered, and also to our Hon. Librarian, Mr. C. D. Gillies, B.Sc., who has devoted a great deal of time to the work of our Society.

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# A CENSUS OF THE ENDOPARASITES RECORDED AS OCCURRING IN QUEENSLAND, ARRANGED UNDER THEIR HOSTS.

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BY T. HARVEY JOHNSTON, M.A., D.Sc., F.L.S.

Walter and Eliza Hall Fellow in Economic Biology in  
the University of Queensland.

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(Read before the Royal Society of Queensland, 27th March,  
1916).

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This paper is offered as the second and more specialised portion of my presidential address (1916b). It is an attempt to bring together, for the first time, a list of all the internal parasites recorded definitely from Queensland, whether protozoon or helminth\*. All records which are not explicit are omitted, *e.g.*, those made by Krefft in 1871, who mentioned that the forms recorded by him, except a few which were more or less localised, were collected in New South Wales or Queensland.

With the exception of Wolffhügel's† catalogue of the parasites of Argentina and Hall's‡ list of those occurring

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\*I have also included members of those genera of Arthropoda which are generally grouped amongst the helminths, *e.g.*, the Linguatulida and the larvae of the botflies, *Oestrus*, *Gastrophilus*, etc. There are, however, many other internal parasites belonging to the phylum, as for example, Copepods and Isopods infesting the gills and buccal cavity of our marine fishes, *Sacculina* in crabs (Port Curtis), Copepods in the mantle cavity of certain Gastropods, *Ascidicola* sp. in the pharynx of *Cynthia præputialis*, *Unionicola* sp. (a mite) in the gills of our freshwater mussels, etc.

†K. Wolffhügel. Los Zooparasitos de los animales domesticos en la Republica Argentina. Rev. Centr. Estud. Agronom. y. Veterin. 1910-11, Buenos Aires.

‡M. Hall. The parasitic fauna of Colorado. Colorado College Publications, Science Series, xii., No. 10, 1912, pp. 329-384.

in Colorado, I do not know of any attempt to list the recorded protozoon as well as helminth endoparasitic fauna of any country. Queensland occupies a large tract of country, larger than many of the European countries taken together, and possesses a vast fauna on land and in its waters, the greater part of which is as yet unsearched for entozoa. This is particularly the case with regard to our fish, reptiles and invertebrates. Even the domesticated animals have not yet been systematically examined. In spite of these facts, the entozoa of Queensland and New South Wales have received much more attention than those of the other Australian States.

In 1909, Dr. G. Sweet published her census of the endoparasites of the native fauna and domesticated animals in Australia (1908), but the protozoa, of which very few were then known, were not included. The number of hosts in Queensland from which worms were definitely there recorded, is considerably less than 40—nearer 30, and of these about one-third were birds in which Dr. T. L. Bancroft (1890a) found filariæ. Since that time, several workers have been engaged in the work and the number of Queensland hosts from which parasites are recorded, is now about 180. From many of them, however, only hæmoprotozoa have been as yet reported. This list comprises about 30 mammals, nearly 90 birds, nearly 30 reptiles, 6 frogs, 18 fish, and about a dozen arthropods. Our molluscs have not yet been searched.

Dr. Sweet's list contains the names of about 80 native and about 15 introduced hosts in Australia recorded as harbouring endoparasites. This is mentioned merely to emphasise the advance which has been made in the past seven years, the chief workers in Queensland parasitology being W. Nicoll, A. Breinl, S. J. Johnston, J. B. Cleland and T. H. Johnston, the two last-named being indebted especially to Dr. T. L. Bancroft for abundant material, much of which still awaits investigation.

A list of the parasites recorded from man and the domesticated animals in Australia was published some years ago (Johnston, 1910b). I have also given a census

of Australian avian\* and reptilian entozoa in 1910 and 1911, respectively, and of the parasites from marsupials and monotremes in 1909 (1909e) and 1911 (1911a). In other papers (Johnston, 1909c, 1910d; Johnston and Cleland, 1912a; Cleland and Johnston, 1912d), there have been collected a large number of records, particularly those relating to the entozoa of man.

The Australian hæmatozoa, especially those of birds and reptiles, have received considerable attention from Cleland and myself (Cleland and Johnston, 1912b, etc.), though other workers, particularly Breinl (1913), have also interested themselves. S. J. Johnston and W. Nicoll have added greatly to our knowledge of the trematode fauna of Eastern Australia, and have worked on material from North Queensland. I have concerned myself with the Cestodes especially and to a less extent with the Nematoda. The lastnamed group has been studied also by Dr. G. Sweet.

### MAMMALIA.

*a* denotes a protozoon; *b*, a trematode; *c*, a cestode; *d*, a nematode including echinorhynch; *e*, an arthropod.

### PRIMATES.

#### HOMO SAPIENS L. (Man).

Amongst the *Chlamydozoa*, if the "cell inclusions" be Protozoon parasites, are the organisms causing

*chickenpox*, *varicella*, *vaccinia* (Guarnieri's bodies, *Cytoryctes vacciniæ*);

*variola*, *smallpox* (*Cytoryctes variolæ*, Guarn.);

*scarlet fever* (*Cyclasterion scarlatinalis*, Mallory, or *Cytoryctes scarlatiniæ*, Siegel—Mallory's bodies).

*trachoma* (Prowazek's bodies);

*cancer* (the parasitic nature of which is still a debatable matter).

*dengue*—apparently a mosquito-borne disease, and probably due to an ultra-microscopic protozoon.

*measles*, *whooping cough*, *cerebrospinal meningitis* and *mumps* which are perhaps caused by unknown protozoa.

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\*A later list of entozoa recorded from Australian birds was published in *The Emu*, Oct., 1912 (Johnston, 1912c.)

No attempt has been made to collect references to the occurrence of these diseases in Queensland, though in Johnston, 1909c, those relating to dengue and smallpox are quoted, whilst Cleland (1913) has given an account of the occurrence of whooping cough, measles and scarlet fever—also (1914c) of dengue in Australia; and Breinl (1913e) (dengue and smallpox)—see also Moore, 1914; O'Brien, 1908; Turner, 1890; Davidson and Scott, A. Med. Gaz., 1911.\*

Amongst the *Proflagellata* (*Spirochaetida*) there may be mentioned

*Treponema pallidum*, Schaud (syphilis).

*Treponema pertenue*, Castell (yaws)—Torres Straits chiefly. Brienl, 1915; Elkington, 1912.

Many of the earlier references will be found in Johnston, 1909c.

The disease of *ulcerating granuloma* (*granuloma pudendi* or *granuloma inguinale*) occurs amongst the aboriginal population in the North (O'Brien, 1908; Jackson, 1911; McLean, 1911; Elkington, 1912; Brienl and Priestley, 1916b). Its causative organism may be *Spirochaeta aboriginalis*, Cleland, or it may (more probably) be caused by *Leishmania* sp.†, which is found infecting some of the cells.

Amongst the Sarcodina, the only one recorded is *Entamoeba histolytica*, Sch., which causes amœbic dysentery and tropical liver abscess.

For references see Johnston 1909c; O'Brien (A. Med. Gaz., 18, 1899). It is endemic in New Guinea (Breinl 1913e, Moore, 1914), Thursday Island and other islets in Torres Straits (Elkington, 1911, 1912, 1912b; Breinl, 1911, 1915, 1913e). *Entamoeba coli*, Loesch, is no doubt common, but I do not know of any record of its presence in this State.

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\*H. L. Cumpston, The History of Smallpox in Australia. Govt. Printer, Melbourne, 1914.

†Cleland, Trans. Austr. Inter. Med. Congr., ix, 1911 (1913), 1, pp. 522-4; Strangman, *Id.*, pp. 518-522; Carter, Lancet, 15th Oct., 1910, p. 1128. See also Castellani and Chalmers, *Man. Trop. Med.*, Ed. 2, 1913, p. 1571; Strangman, A. Med. Gaz., 1911, p. 76; p. 446; Breinl and Priestley, 1916b.

All three forms of malaria are known from Queensland, viz., tertian or benign tertian (*Plasmodium vivax*, Gr. and Fel.), quartan (*P. malariae*, Lav), and intermittent or malignant tertian fever (*P. falciparum*, Lemaire). The last has been introduced, chiefly by miners, from New Guinea, where it is endemic (Breinl; Elkington; Booth-Clarkson; Moore, 1914\*).

For references see Johnston, 1909c; Cleland, 1914c; Turner, 1890; Breinl, 1912, 1913e, 1915; O'Brien, 1908; Butler, 1912; Elkington, 1910, 1912, 1912c; Breinl and Priestley, 1916a.

All three types occur in districts of North Queensland, some of them being now endemic (e.g., *P. vivax*—in Cairns [Moore, 1914], and Port Douglas.†).

O'Brien (1908), states that the type is almost always tertian, and only occasionally is quartan or malignant malaria met with in Northern Queensland.

No trematode parasites have been recorded as far as I know, though a number of cases of Schistosomiasis occurred in Queensland, amongst men who had become infected by *Schistosomum hæmatobium*, Bilh., during the South African (Boer) War.

Two Cestodes have been reported.

*Tænia saginata*, G., Instn., 1910b; 1910f (Brisbane), Nicoll, 1914d (N.Q.)—apparently uncommon in this State.

*Echinococcus granulosus*, B. (the hydatid stage, more commonly known as *Echinococcus hominis* or *E. veterinorum*, R.). For references see Johnston, 1909c; rare in N.Q. (Nicoll, 1914d);

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\*R. F. Jones gave an account of the "Diseases of British New Guinea" (Tr. Soc. Trop. Med. Hyg., January, 1911; Abstr. in A. Med. Gaz., June, 1911, p. 356). Amongst those met with were malaria, both simple tertian and æstivo-autumnal; amœbic dysentery and liver abscess; *Filaria bancrofti*; ulcerating granuloma; and dengue (imported); while Ankylostomiasis was encountered only in that part which was then known as German New Guinea.

†See Brisbane Courier of May 27, 1916, p. 6, regarding the presence of Malaria in Cairns and Port Douglas (Q.) and Overland Corner (S. Australia).

Turner, 1890; Cleland, 1912*b*; Elkington, 1912*c*; Cameron, Turner and Gibson (A.M.G., 34, 1913, p. 436).

Many nematodes have been recorded from man in Queensland.

*Ascaris lumbricoides*, L., Flynn, 1901; Jnstn., 1910*b* (Brisbane); Nicoll, 1914*d*, N.Q.—uncommon.

*Oxyuris vermicularis*, Linn., Jnstn., 1910*b*; 1910*f* (Brisbane); Nicoll, 1914*d* (N.Q.)

*Trichinella spiralis*, Owen., Halford, 1898.

*Trichuris trichiura*, L. (*Trichocephalus dispar*, Rud.), Hogg, 1889*a*; Bacot, 1892 (N.Q.); Bancroft, 1893*c* (Brisbane); Lawes, 1895; Jnstn., 1909*c*, 1910*b*; J. and C., 1912*a*; Nicoll, 1914*d*.

*Strongyloides intestinalis*, Bavay (*Rhabdonema stercoralis*, Bav.); Ashworth, 1896; J. and C., 1912*a*; Breinl, 1913*d*; Nicoll, 1914*d* (N.Q.).

*Ancylostoma*\* *duodenale*, Dub. (*Anchylostoma*, *Ankylostoma*)—the commoner hook worm.

For summary of references see Jnstn., 1909*c*, and Jnstn. and Clel., 1912*a*; Hogg, 1889*b*, *c* (Goodna); Bacot, 1892 (N.Q.); Gibson, 1892 (Maryborough), 1895; Gibson and Turner, 1892 (N.Q.); T. L. Bancroft, 1893*c*, 1893*d*, 1902; Turner, 1895 (Brisbane) 1896, 1909; Love, 1895; Ashworth, 1895, 1896; Lawes, 1895; Hardie, 1897 (Cairns); O'Doherty, 1898; Hamilton-Kenny, 1906 (Gympie); Macdonald, 1908 (N.Q.); O'Brien, 1908 (N.Q.); Salter, 1909 (Brisbane); Leiper, 1908; Halford, Gibson, Robertson, 1909; Breinl, 1913*e*, 1913*f*, 1913*d* (N.Q.); Macdonald (in Breinl, 1913*e*)—Gulf Country; Nicoll, 1914*d* (N.Q.); Breinl, 1911, 1915; Ham, 1909; Booth-Clarkson, 1913; Salter, 1911; Croll, 1911; Elkington, 1910, 1911, 1911*b*, 1912, 1912*c*; W. Macdonald, 1911; Cameron, 1913.

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\*This spelling of the name has been recently (1916) adopted by the International Commission on Zoological Nomenclature.

*Necator americanus*, Stiles (a hook worm). Leiper, 1908, from Bancroft; Breinl, 1913*d*, 1915 (N.Q. and New Guinea); Nicoll, 1914*d* (N.Q.); W. Macdonald, 1911.

*Filaria bancrofti*, Cobbold, the larva of which inhabits the blood, and is known as *Microfilaria nocturna*, Manson, or *M. sanguinis hominis*, Lewis.

For summary see Johnston, 1909*c* and Jnstn. and Clcl., 1912*a*; Cobbold, 1876*a*, 1876*b*, 1877, 1879*a*, 1879*b*; J. Bancroft, 1876, 1878, 1879, 1882*a*, 1882*b*, 1889, 1892; Love, 1889; Turner, 1890; Hoggan, 1892; Jackson, 1893; T. L. Bancroft, 1893*d*, 1898, 1899*a*, 1899*b* and 1903*a*, 1900, 1901; P. Bancroft, 1893, 1908, 1910; Flynn, 1903; Sawkins, 1903; Macdonald, 1905; O'Brien, 1908; Jackson, 1908, 1910; Maclean, 1908, 1909, 1910; Salter, 1908; Breinl, 1913*b*, 1913*d*, 1913*e*; Jackson, 1913; Nicoll, 1914*d*; Nisbet, 1915; Booth-Clarkson, 1913; Harris and Elkington, 1912; Croll, 1911; Bancroft, 1912; Butler, 1912; Elkington, 1912; 1912*b*, 1912*c*; Breinl, 1911. 1915; Ham, 1909.

The participation of Australian troops in the Great War will almost certainly lead to the introduction, if not the establishing, of certain parasitic diseases from other lands. We know that many men have returned from New Guinea stricken with various forms of malaria\*.

*Giardia* (*Lambia*) *intestinalis* has caused severe diarrhoea both in Flanders and Gallipoli (Porter, Proc. Linn. Soc. Lond., 2nd March, 1916, No. 317). Amœbic dysentery (due to *Entamœba histolytica*) occurred at the latter locality. Cameron (1916) has recorded its presence in a returned Queensland soldier.

In Egypt there is an abundant human helminth fauna, and it is possible that such trematodes as *Schistosomum*, *Heterophyes* and *Paragonimus* may be introduced to Australia. Leiper has recently investigated the life history† of *Schistosomum hæmatobium*, Bilh., and has

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\*Breinl and Priestley, 1916*a*.

†R. T. Leiper. Report on the Results of the Bilharzia Mission in Egypt, 1915. Jour. R.A. Medical Corps, July and Aug., 1915. Abstract in *Nature*, 13 January, 1916, p. 551.

proved that several species of a freshwater mollusc, *Planorbis* sp., can act as intermediate hosts. Species of this genus are common in our water supply and in ponds, and no doubt could serve as a host just as some other species of freshwater gastropods have become the intermediate hosts of the liver fluke, *Fasciola hepatica*, in Australia.

One need only mention that Ankylostomes are particularly abundant in Egypt. They are widely spread amongst the inhabitants of our own coastal districts.

Given certain conditions, there is danger that some of these parasites may become endemic.

**MACACUS CYNOMOLGUS**, Linn (macaque monkey—introduced)

I have identified both *Trichuris trichiura* and *Oesophagostoma apistomum*, Will., amongst material collected in Queensland.

#### UNGULATA.

**EQUUS CABALLUS**, L. (Horse)—introduced.

c. *Anoplocephala perfoliata*, G., Jnstn., 1910b.

d. *Ascaris equorum*, G. (*A. megalocephala*, Cloq.), Jnstn., 1910b.

*Oxyuris equi*, Schr. (*O. curvula*, R.), Jnstn., 1916c.

*Spiroptera* (= *Acuaria*) *megastoma*, R., Tucker, 1914, N.Q ; Jnstn., 1914c (Burnett).

*Habronema microstoma*, Schn. Jnstn., 1916c.

*Strongylus equinus*, Mull. (*Strongylus armatus*), Cory, 1913, 1914 ; Jnstn., 1916c.

*Cylicostomum tetracanthum*, Mehl., Cory, 1913, 1914 ; Jnstn., 1916c

e *Gastrophilus nasalis*, L, Tryon, 1908, 1910, 1912 ; Jarvis, 1913 (S.E.Q.).

**SUS SCROFA**, L. (pig)—introduced.

d. *Ascaris suum*, G., Jnstn., 1916c.

*Stephanurus dentatus*, Dies. (syn. *Sclerostoma pingwicola*, Verrill)—kidney worm—Baneroff, 1893a, c ; Dodd, 1909 ; Jnstn., 1910b., 1912b ; Cory, 1914.

**BOS TAURUS**, dom. (ox)—introduced.

- a. "Sarcosporidiosis" Dodd, 1909 (= *Sarcocystis tenella*, Bl.)

*Babesia bovis* (generally known as *Piroplasma bigeminum*, Kilb. and Smith)—redwater parasite—Pound, 1895-1915; Fuller, 1896, 1899; Gordon, 1898-1903; Hunt, 1897-9; Hunt and Collins, 1896-7; Tidswell, 1899, 1900; Dodd, 1908, 1909, 1910; Richards, 1898; Greig Smith, 1899; Gilruth, 1912; Wynne, 1896; Thorn, 1912; Cory, 1912, 1913; Tucker, 1914; Wallace, 1908; Ramm, 1911; Barnes, 1896; Gordon and Pound, 1897.

Dr. Dodd (1910d) thought that there was a second parasite (? *Piroplasma mutans*) in Queensland cattle, but Thorn (1912) does not agree with him. Cory (1913) also suspected the presence of a second organism resembling *P. bigeminum*.

*Anaplasma marginale*, Theiler? Gilruth, Sweet and Dodd, 1911.

- b. *Paramphistoma cervi* (*Amphistomum conicum*), Cobb, 1891 (N.Q.); Jnstn., 1910b; Tryon, 1915 (Brisban?).

*Fasciola hepatica*, Abildg. Jnstn., 1910b, 1912b; Cory, 1912 (S.Q.).

- c. *Tænia*, sp., Pound, 1899. (Probably = *Moniezia expansa*).

*Moniezia expansa*, R., Jnstn., 1910b.

*Moniezia planissima*, St. and Has. Jnstn., 1916c.

*Echinococcus granulosus*, Gm. (hydatid), Pound, 1899; Jnstn., 1910b.

*Cysticercus bovis*. This has not been recorded, but its presence may be inferred from the occurrence, though uncommon, of *Tænia saginata* in Queensland; Cory, 1912 (S.Q.).

- d. *Dictyocaulus viviparus*, Bl. (syn. *Strongylus micrurus*, Mehlis). Cory, 1910a, 1912, records the presence of "lung worm" in calves.

*Hæmonchus contortus*, R. (stomach worm); Barnes, 1898; Dodd, 1908, 1909.

*Trichostrongylus extenuatus*, Raill. (syn. *Strongylus gracilis*, McFadyen, nec Leuckt), Dodd, 1909.

*Ostertagia circumcincta*, Stadelm (syn. *Strongylus cervinicornis*, McFad.), Dodd, 1909.

*Oesophagostoma radiatum*, Rud., Jnstn., 1910b, 1916c. (Brisbane).

*Oesoph. columbianum*, Curtice. Bancroft, 1893; Barnes, 1898. Should have been recorded as *Oes. radiatum* (*Oes. inflatum*, Schn.)

*Trichuris ovis*, Abildg. (syn. *Trichocephalus affinis*), Dodd, 1909; Jnstn., 1910b.

*Onchocerca gibsoni*, Clel. and Jnstn (the cause of worm nodules in Queensland cattle). For literature, see Jnstn., 1911b; Gibson, 1892; Bancroft, 1893a; Barnard and Park, 1894; Park, 1893; Pound, 1909; Tryon, 1910a, 1910b, 1911; Dodd, 1910; Cleland and Johnston, 1910a, 1910b, 1910c, 1910h, 1910g, 1911a, 1911b; Jnstn. and Clel., 1910a; Jnstn, 1911b, 1911d, 1916b; Robinson, 1910, 1911; Hancock, 1910; Macfadden, 1911; Leiper, 1911a, b; Gilruth, 1912; Gilruth and Sweet, 1911, 1912a, b; Breinl, 1913a; Nicoll, 1911, 1914c; Cleland, 1912, 1914a, 1914b; Thorn, 1912; Tryon, 1914; Pound, 1911; Nicoll, 1915b.\*

e. *Hypoderma bovis*, L. (Warble), Tryon, 1912; 1915; McGown, 1915; Pound, 1915 (in imported cattle).

OVIS ARIES, L. (sheep)—introduced.

b. *Fasciola hepatica*, Abildg. (liver fluke), Jnstn., 1910b, 1912b.

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\*In a recent paper (1916b) in which I gave a summary of recent work relating to this parasite, I omitted any reference to Dr. Nicoll's last paper (1915b), as I was not aware of it until lately. He has published an account of his efforts to find worms and larvae in ten calves under a year old, in which he could not detect "worm nests" whilst the animals were alive. His findings were all negative though the parasites were searched for in a most careful manner.

c. *Moniezia expansa*, R., Jnstn., 1916c.

*Echinococcus granulosus*, Gm. (hydatid), Jnstn., 1910b.

*Tænia hydatigena*, Pall.—larva (*Cysticercus tenuicollis*, Dies.), Jnstn., 1916c.

d. *Hæmonchus contortus*, R. (stomach worm), Barnes, 1898; Dodd, 1908, 1909; Cory, 1914; Brown, 1913. There are many references to "stomach worms"—Cory, Tucker, Brown.

*Trichostrongylus extenuatus*, Raill. (syn. *Strongylus gracilis*, McFadyen), Dodd, 1909.

*Ostertagia circumcincta*, Stadelm. (syn. *Strongylus cervinicornis*, McFadyen), Dodd, 1909.

*Dictyocaulus filaria*, Rud. (lung-worm), Jnstn., 1910b.

*Oesophagostoma columbianum*, Curtice; Barnes, 1898; Jnstn., 1910b.

*Trichuris ovis*, Abildg.; Jnstn., 1910b; 1916c (Burpengary, per H. Tryon—collected by W. G. Brown).

*Onchocerca gibsoni*, C. and J., Pound, 1911.

*Oestrus ovis*, L.—sheep bot. Tryon, 1907, 1914, 1915; Jarvis, 1913 (S.Q.); Brown, 1913, 1914.

CAPRA HIRCUS, L. (goat)—introduced.

*Echinococcus granulosus*, Gm. (hydatid), Jnstn., 1910f.

## CARNIVORA.

CANIS FAMILIARIS, L.—dog—introduced.

c. *Dipylidium caninum*, L., Jnstn., 1912b (Brisbane), 1913 (N.Q.); Nicoll, 1914d (N.Q.).

*Echinococcus granulosus*, Gmel. (generally known as *Tænia echinococcus*, Sieb.) The presence of the adult stage of this parasite in dogs may be safely inferred from the occurrence of the hydatid stage in various animals in this State.

*Tænia hydatigena*, Pall. (syn. *T. marginata*, Batsch—its presence in dogs may be inferred from the occurrence of *Cysticercus tenuicollis*, Dies.

d. *Toxascaris* (= *Toxocara*) *canis*, Werner. Jnstn., 1912b (Brisbane); Nicoll, 1914d (Ascarids—N.Q.)

*Ancylostoma caninum*, Ercol (hookworm), Bancroft, 1901a; Jnstn., 1912b (Brisbane); Breinl, 1913d; Nicoll, 1914d (N.Q.)

*Dirofilaria immitis*, Leidy (heart worm), Bancroft, 1889, 1893 (Brisbane); Breinl, 1913d; Nicoll, 1899, 1893c, 1901a, 1903b (Brisbane); Breinl, 1913d; Nicoll, 1914d (N.Q.); Tucker, 1912 (N.Q.).

FELIS CATUS, dcm. (cat)—introduced.

c. *Dibothriocephalus felis*, Cr., Jnstn., 1912b (S.Q.), 1913 (N.Q.).

*Tænia tæniæformis*, Bl. (generally known as *T. crassicollis*, R.), Jnstn., 1912b.

*Dipylidium caninum*, L., Jnstn, 1912b (S.Q.); Nicoll, 1914d (N.Q.).

d *Belascaris felis*, G. (syn. *Asc. mystax*, R.), Jnstn, 1912b.

*Ancylostoma caninum*, Erc., Jnstn. 1912b (S.Q.): Breinl. 1913d (N.Q.).

## RODENTIA.

MUS MUSCULUS, L. (mouse)—introduced.

c. *Tænia tæniæformis*, Bl., in its cystic stage (*Cysticercus fasciolaris*), Jnstn., 1916c.

d. *Oxyuris obvelata*, Brems., Jnstn., 1912b.

*Capillaria hepatica*, Raill. (syn. *Trichosoma hepaticum*), Jnstn., 1912b.

*Spiroptera* (= *Acuaria*) *obtusa*, R., Jnstn., 1912b.

EPIMYS NORVEGICUS, Erxl. (syn. *Mus decumanus*, Pall—the brown rat)—introduced.

a *Trypanosoma lewisi*, Kent., Pound, 1907 (Brisbane).

c *Hymenolepis diminuta*, R., Jnstn, 1912b (Brisbane), 1913 (N.Q.)

*Tænia tæniæformis*, Bl., in its cystic stage (*Cysticercus fasciolaris*), Jnstn, 1912b (Brisbane).

d *Heterakis spumosa*, Schn., Jnstn., 1912b.

*Oxyuris obvelata*, Brems., Jnstn., 1912b.

*Spiroptera obtusa*, R., Jnstn., 1912b.

*Capillaria hepatica*, Raill., Jnstn., 1912b.

*Trichodes crassicauda*, Bell. Jnstn., 1912b.

*Gigantorhynchus moniliformis*, Br., Jnstn., 1913 (N.Q.).

**EPIMYS RATTUS**, L., including var. **ALEXANDRINUS** (house rat)—introduced.

*a Trypanosoma lewisi*, Kent., Jnstn., 1916c (Brisbane).

*c Hymenolepis diminuta*, R., Jnstn., 1912b.

*Tænia tæniæformis*, Bl. (*Cysticercus fasciolaris*, R.)—Jnstn., 1912b (Brisbane).

*d Heterakis spumosa*, Schn., Jnstn., 1912b.

*Oxyuris obvelata*, Brems., Jnstn., 1912b.

*Capillaria hepatica*, Raill., Bancroft, 1893 (as *Trichocephalus hepaticus*, Bancr.); Jnstn., 1912b (Brisbane).

*Spiroptera obtusa*, R., Jnstn., 1912b.

*Gigantorhynchus moniliformis*, Br., Jnstn., 1912b (Brisbane).

**RATS** (unspecified).

*a Trypanosoma lewisi*, Kent., Bancroft, 1888 (Brisbane —as *Hæmatomonas* sp.), Breinl, 1913c (N.Q.)

*Coccidium* sp. from rat's liver, Bancroft, 1891. (=ova of *Capillaria hepaticum*, Raill., a nematode).

*d Gigantorhynchus moniliformis*, Br., Nicoll, 1914d (N.Q.)

## CHIROPTERA.

**PTEROPUS GOULDI**, Peters. (Gould's flying fox).

*a Trypanosoma pteropi*, Breinl, 1913c (N.Q.)

*Plasmodium pteropi*, Breinl, 1913c (N.Q.).

**PTEROPUS POLIOCEPHALUS**, Temm.

*c Hymenolepis* sp. Jnstn., 1916c (Caloundra).

*d Filaria* sp., in body cavity. Jnstn., 1916c (Brisbane).

## SIRENIA.

**DUGONG DUGONG**, Mull. (syn. **HALICORE DUGONG**)—dugong.

*b Opisthotrema pulmonale*, Linstow, 1904 (Torres Straits).

*Rhabdiopæus taylori*, S. J. Jnstn., 1913 (N.Q.)

## MARSUPIALIA.

**MACROPUS GIGANTEUS**, Zimm. (syn. *M. major*, Shaw)—  
kangaroo.

*d Filaria websteri*, Cobb., Jnstn, 1912*b*; T. L. Bancroft,  
1889 (as *Filaria* sp.).

**MACROPUS DORSALIS**, Gray.

*c Echinococcus granulosus*, Gm. (hydatid), T. L.  
Bancroft, 1890.

*d Filaria websteri*, Cobbold, Jnstn., 1912*b*.

**MACROPUS PARRYI**, Bennett.

*a Coccidium (Eimeria)* sp., Jnstn., 1910*f*.

*d Filaria websteri*, Cobb, Jnstn., 1912*b*.

**MACROPUS DERBYANUS**, Gray.

*c Moniezia festiva*, Rud., Cobbold, 1879 (from Dr. J.  
Bancroft's collection, and presumably from  
Queensland):

=**HALMATURUS** sp. (=MACROPUS sp.).

*c Taenia mastersii*, Krefft, 1871.

**KANGAROO** (probably=*M. giganteus*).

*d Filaria websteri*, Cobbold, 1879; Bancroft, 1893*c*.

**WALLABIES.**

*c ? Bothriocephalus marginatus*, Krefft, 1871.

*Taenia fimbriata*, Krefft, 1871, nec. Diesing=  
*T. Krefftii*, Jnstn., 1909*e*, and is probably a  
*Cittotænia*.

**DENDROLAGUS BENNETTIANUS**, De Vis, a tree kangaroo.

*d Filaria* sp., Jnstn, 1910*e*; 1911*a* (N.Q.).

**ONYCHOGALE FRENATA**, Gould; a nail-tailed wallaby.

*c Cittotænia bancrofti*, Jnstn., 1912*b*.

**PHASCOLARCTUS CINEREUS**, Goldf.—native bear.

*c Bertiella obesa*, Zsch., 1898, 1899. Cobbold's *Taenia*  
*geophiloides*, 1879—a nomen nudum—is the same.

**TRICHOSURUS VULPECULA**, Kerr—common opossum.

*d Filaria dentifera*, Linstow, 1898 (Burnett).

*Filaria trichosuri*, Breinl, 1913*d*. (N.Q.).

**PERAMELES OBESULA**, Shaw—bandicoot.

*c* *Linstowia semoni*, Zsch., 1898, 1899 (Burnett).

*d* *Echinonema cinctum*, Linst., 1898 (Burnett).

*Gigantorhynchus semoni*, Linst., 1898 (Burnett).

### MONOTREMATA.

**TACHYGLOSSUS ACULEATUS**, Shaw (syn. *Echidna hystrix*, Home)—the echidna or ant-eater.

*c* *Linstowia echidnae*, Thomp., Zschokke, 1898, 1899.

I have received specimens from the Upper Burnett (Dr. T. L. Bancroft). Cobbold's *Tænia phoptica* (1879)—a nomen nudum—belongs to the same species.

*Cittotænia tachyglossi*, Jnstn., 1913 (N.Q.).

*Cittotænia* sp., Nicoll, 1914d (N.Q.).

### AVES.

#### CASUARIIFORMES sp.

**DROMÆUS NOVÆHOLLANDIÆ**, Lath (The emu).

*c* *Davainea australis*, Kr., Johnston, 1916c (Eidsvold).

#### GALLIFORMES.

**CATHETURUS LATHAMI**, Gray (The brush turkey).

*a* *Hæmoproteus* sp.\* Cleland and Johnston, 1911c (S.Q.); Cleland, 1915b. (S.Q.).

*d* *Heterakis bancrofti*, Jnstn, 1912b. (S.Q.).

*Heterakis catheturinus*, Jnstn., 1912b (S.Q.)

*Echinorhynchus* (*Gigantorhynchus*) sp., Jnstn., 1912c (S.Q.).

**GALLUS DOMESTICUS** (the domestic fowl)—introduced.

*a* *Spiroschaudinnia* (*Spirochæta*, *Treponema*) *gallinarum*, March—organism of fowl tick-fever. Dodd, 1909.

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\*Generally recorded as *Halleridium* but *Hæmoproteus* appears to be the correct name. Minchin (Intro. Study Protozoa, 1912), however prefers the former.

- c Hymenolepis carioca*, Mag., Jnstn., 1912*b* (Brisbane).  
*Amœbotœnia cuneata*, Linst., Jnstn., 1912*b* (Brisbane).  
*Davainea cesticillus*, Molin., Jnstn., 1912*b* (Brisbane).  
*Davainea tetragona*, Molin\*, Sweet, 1910 (Rockhampton);  
 Jnstn., 1912*b* (Brisbane).  
*d Ascaridia perspicilla* (syn. *Heterakis inflexa*, R.),  
 Jnstn., 1912*b* (Brisbane); Nicoll, 1914*d* (N.Q.);  
 Tryon, 1915; Jnstn., 1912*b* (Brisbane).  
*Heterakis vesicularis* (syn. *H. papillosa*, Bl.), Jnstn.,  
 1912*b* (Brisbane); Nicoll, 1914*d* (N.Q.)  
*Oxyspirura parvovum*, Sweet, 1910 (Rockhampton,  
 Cairns); Breinl, 1913*d* (N.Q.); Nicoll, 1914*d* (N.Q.)  
*Oxyspirura mansonii*, Cobbold. Tryon, 1908 (N.Q.);  
 Dodd, 1909 (N.Q.)—probably the same as the  
 preceding species.

## COLUMBIFORMES.

LAMPROTHERON SUPERBA, Temm. (purple-breasted fruit pigeon).

- a Hæmoproteus columbæ*, C. and S., Breinl, 1913*c* (N.Q.)

## RALLIFORMES.

PORPHYRIO MELANONOTUS, Temm. (bald coot).

- b Echinostoma hilliferum*, Nicoll, 1914*b* (N.Q.)

## CHARADRIIFORMES.

LOBIVANELLUS LOBATUS, Vieill. (Spurwing plover).

- b Echinostoma ignavum*, Nicoll, 1914*b* (N.Q.)  
*Hæmatotrephus consimilis*, Nicoll, 1914*b* (N.Q.)  
*Notocotylus attenuatus*, Rud., Nicoll, 1914*b* (N.Q.)  
*c Gyrocœlia* sp., Jnstn., 1914*a* (N.Q.)

NUMENIUS CYANOPUS, Vieill (sea curlew).

- b Echinostoma* (*Acanthochasmus*) sp., Jnstn., 1912*c*  
 (Gladstone).  
*d Echinorhynchus* sp., Jnstn., 1912*c* (Gladstone), 1914*a*  
 (N.Q.)

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\*Attention is drawn to a misprint in Johnston, 1910*g*, p. 117, where should read that *Davainea* sp. Bradshaw is *D. tetragona*, Molin.

GALLINAGO AUSTRALIS, Lath. (snipe).

*c Aploparaksis australis*, Jnstn., 1913 (N.Q.)

BURHINUS GRALLARIUS, Lath. (stone plover; land curlew).

*b Platynotrema biliosum*, Nicoll, 1914*b* (N.Q.).

*Platynotrema jecoris*, Nicoll, 1914*b* (N.Q.).

*Notocotylus attenuatus*, Rud., Nicoll, 1914*b* (N.Q.)

#### GRUIFORMES.

ANTIGONE AUSTRALASIANA, Gould (native companion).

*b Allopyge antigones*, S. J. Jnstn., 1913 (N.Q.).

*Echinostoma australasianum*, Nicoll, 1914*a* (N.Q.)

#### IBIDIFORMES.

IBIS MOLUCCA, Cuv. (white ibis).

*b Echinostoma* sp., Jnstn., 1912*c* (Eidsvold) = *Patagifer bilobus*, R., Jnstn., 1916*c*.

*Platynotrema biliosum*, Nicoll, 1914*b* (N.Q.).

CARPHEIBIS SPINICOLLIS, Reichb. (straw-necked ibis).

*b Echinostoma acuticauda*, Nicoll, 1914*b* (N.Q.)

*Patagifer bilobus*, R., Nicoll, 1914*b* (N.Q.).

PLEGADIS FALCINELLUS, Linn. (glassy ibis).

*b Patagifer bilobus*, R., Nicoll, 1914*b* (N.Q.).

PLATALEA REGIA, Gould (blackbilled spoonbill).

*b Orchipezum sufflavum*, Nicoll, 1914*b* (N.Q.)

*Patagifer bilobus*, R., S. J. Jnstn., 1913 (N.Q.)

*c Cyclorchida omalancristota*, Wed., Jnstn., 1913 (N.Q.).

PLATIBIS FLAVIPES, Gould (yellow-billed spoonbill).

*c Hymenolepis ibidis*, Jnstn., 1913 (N.Q.).

#### CICONIIFORMES.

XENORHYNCHUS ASIATICUS, Lath. (jabiru; Australian stork).

*b Chaunocephalus ferox*, Rud., Nicoll, 1914*b*. (N.Q.)

#### ARDEIFORMES.

HERIODAS TIMORIENSIS, Less. (white egret).

*b Echinostoma* sp., Jnstn., 1912*c*. (S.Q.).

*c Anomotænia asymmetrica*, Jnstn., 1913 (N.Q.)

*Bancroftiella glandularis*, Fuhr., Jnstn., 1913 (N.Q.)

NOTOPHOYX NOVÆHOLLANDIÆ, Lath. (white-fronted heron).

*a Trypanosoma notophoyxis*, Breinl, 1913c (N.Q.).

*Hæmoproteus danilewskyi*, Gr. and Fel., Breinl, 1913c (N.Q.).

*c Bancroftiella glandularis*, Fuhrm., Jnstn., 1913 (N.Q.); 1914a (N.Q.).

NYCTICORAX CALEDONICUS, Gmel. (night heron).

*b Clinostomum hornum*, Nicoll, 1914b (N.Q.).

*c Bancroftiella ardeæ*, Jnstn., 1913 (N.Q.).

BOTAURUS PÆCILOPTILUS, Wagl. (bittern).

*b Clinostomum hornum*, Nicoll, 1914b (N.Q.).

### ANSERIFORMES.

CHENOPSIS ATRATA, Lath. (black swan).

*a ? Plasmodium\* (Proteosoma) biziuræ*, Gilr. and Sweet. Cleland, 1915 (Burnett R.).

*b Echinostoma revolutum*, R., Nicoll, 1914b (N.Q.).

*Notocotylus attenuatus*, R., Nicoll, 1914b (N.Q.).

ANSERANAS SEMIPALMATA, Lath. (pied goose).

*b Typhlocœlium reticulare*, S. J. Jnstn., 1913 (N.Q.).

*Echinostoma revolutum*, R., Nicoll, 1914b (N.Q.).

*Notocotylus attenuatus*, R., Nicoll, 1914b (N.Q.).

*c Hymenolepis megalops*, Nitzsch., Jnstn., 1913 (N.Q.).

*Hymenolepis terræreginæ*, Jnstn., 1913 (N.Q.).

NETTOPUS PULCHELLUS, Gould (green gooseteal).

*b Echinostoma revolutum*, R., Nicoll, 1914b (N.Q.).

*Notocotylus attenuatus*, R., Nicoll, 1914b (N.Q.).

DENDROCYGNA ARCUATA, Horsf. (whistling duck).

*c Diploposthe lævis*, Bl., Jnstn., 1913 (N.Q.).

ANAS SUPERCILIOSA, Gmel. (black duck).

*b Echinostoma* sp. (= *E. revolutum*), Jnstn., 1912b (S.Q.).

*Echinostoma revolutum*, R., S. J. Jnstn., 1913 (N.Q.); Nicoll, 1914b (N.Q.).

*Notocotylus attenuatus*, R., Nicoll, 1914b (N.Q.).

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\*Minchin (An Introd. to the Study of Protozoa, 1912, p. 358) regards the correct generic name to be *Plasmodium*, whilst Doflerr (Lehrb. Protozoenk, 1911, p. 771) retains *Proteosoma*.

*c* *Diorchis flavescens*, Krft., Jnstn., 1912*b* (S.Q.); 1913 (N.Q.).

*Hymenolepis megalops* N., Jnstn., 1912*b* (S.Q.).

AYTHYA AUSTRALIS, Eyton (Widgeon, white-eyed duck).

*c* *Diploposthe lævis*, Bl., Jnstn., 1912*b* (S.Q.)

#### PELICANIFORMES (STEGANOPODES).

PHALACROCORAX SULCIROSTRIS, Brandt (little black cormorant).

*d* *Ascaris spiculigera*, R., Jnstn., 1912*b* (S.Q.).

*Filaria* sp., Jnstn., 1912*b* (S.Q.); Cleland, 1915 (S.Q.).

PLOTUS NOVÆHOLLANDIÆ, Gould (snake bird, darter).

*d* *Ascaris spiculigera*, R., Jnstn., 1912*b* (S.Q.).

*Filaria* sp., Jnstn., 1912*b* (S.Q.); Cleland, 1915*b* (S.Q.).

FREGATA AQUILA, L. (frigate bird).

*c* *Tetrabothrius* sp., Jnstn., 1912*c* (Masthead I.).

#### ACCIPITRIFORMES.

ASTUR NOVÆHOLLANDIÆ, Gm. (white goshawk).

*d* *Gigantorhynchus asturinus*, Jnstn., 1912*b* (N.Q.).

ACCIPITER CIRRHOCEPHALUS, Vieill. (sparrow hawk).

*c* *Anomotaenia accipitris*, Jnstn., 1913 (N.Q.)

*d* *Filaria* sp., Clel and Jnstn., 1911*c* (S.Q.).

HALLASTUR GIRRENERA, Vieill. (white-headed sea-eagle).

*a* *Trypanosoma avium majus*, Dainl. Breinl, 1913*c* (N.Q.)

*Hæmoproteus danilewskyi*, G. and F., Breinl, 1913*c* (N.Q.).

FALCO HYPOLEUCUS, Gould (grey falcon).

*a* *Trypanosoma avium*, Dainl., Breinl, 1913*c* (N.Q.).

*Proteosoma præcox*, G. and F., Breinl, 1913*c* (N.Q.).

HIERACIDEA BERIGORA, V. and A. (striped brown hawk).

*b* *Opisthorchis obsequens*, Nicoll, 1914*b* (N.Q.).

HIERACIDEA ORIENTALIS, Schl. (brown hawk\*).

*b* *Opisthorchis obsequens*, Nicoll, 1914*b* (N.Q.).

*Echinochasmus prosthovitelatus*, Nicoll, 1914*b* (N.Q.).

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\*Nicoll, 1914*d*, mentions the occurrence of eye worms in the brown hawk and in the wedgetailed eagle (= *Uroæetus audax*) in N.Q.

## STRIGIFORMES.

NINOX BOOBOOK, Lath. (boobook owl).

*a Trypanosoma* sp., Breinl, 1913c (N.Q.).

*Hæmoproteus noctuæ*, Sch., Breinl., 1913c (N.Q.).

*Hæmoproteus (Halteridium)* sp., Clel. and Jnstn., 1911c, (S.Q.); Clel., 1915b (S.Q.); apparently the same as the preceding.

*b Strigea promiscua*, Nicoll, 1914a (N.Q.).

*d Echinorhynchus* sp., Jnstn., 1912c, (S.Q.).

NINOX MACULATA, V. and H. (spotted owl).

*b Hemistomum brachyurum*, Nicoll, 1914a (N.Q.).

*Strigea promiscua*, Nicoll, 1914a (N.Q.).

NINOX STRENUA, Gould (powerful owl).

*a Hæmoproteus* sp., Cleland, 1915b (S.Q.).

## PSITTACIFORMES.

TRICHOGLOSSUS NOVÆHOLLANDIÆ, Gm. (bluebellied lorikeet, Blue Mountains parroquet).

*c Moniezia trichoglossi*, Linstow, 1888 (Cape York); Jnstn., 1912c (N.Q.); 1913 (N.Q.).

*d Filaria* sp., Bancroft, 1889; 1893c (S.Q.).

GLOSSOPSITTACUS PUSILLUS, Shaw (small green leek; little lorikeet).

*d Filaria* sp., Clel. and Jnstn., 1911c (Gladstone, Burnett).

CACATUA GALERITA, Lath. (white cockatoo; sulphur-crested cockatoo).

*c Davainea cacatuina*, Jnstn., 1913 (N.Q.).

PLATYCERCUS EXIMIUS, Shaw (rosella parroquet).

*c Dilepis bancrofti*, Jnstn., 1912d (S.Q.).

## CORACIIFORMES.

PODARGUS STRIGOIDES, Lath. (mopoke).

*a Leucocytozoon* sp., Cleland, 1915b (S.Q.).

*b Strigea flosculus*, Nicoll, 1914a (N.Q.).

*d Filaria* sp., Bancroft, 1889; Clel. and Jnstn., 1911c; Clel., 1915b (S.Q.).

NIGHTJAR, probably *P. STRIGOIDES*.

*d. Echinostoma elongatum*, Nicoll, 1914a (N.Q.).

ÆGOTHELES NOVÆHOLLANDIÆ, Lath. A nightjar.

*d. Filaria* sp. (microfilaria). Jnstn., 1916c (Eidsvold).

EURYSTOMUS PACIFICUS, Lath. (Dollar bird, Roller).

*d. Filaria* sp., Bancroft, 1889; Clel. and Jnstn., 1911c; Clel., 1915b (S.Q.).

*Echinorhynchus* sp., Jnstn., 1912c (S.Q.).

DACELO LEACHII, V. and H. (Leach's Kookooburra).

*d. Filaria daceilonis*, Breinl, 1913d (N.Q.). This parasite belongs to the genus *Ceratospira* = [*C. dacelonis* (Breinl), Jnstn., 1916].

MEROPS ORNATUS, Lath. (bee eater).

*a. Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).

## CUCULIFORMES (COCCYGES).

EUDYNAMIS CYNAOCEPHALA, Lath. (a cuckoo).

*a. Hæmoproteus danilewskyi*, G. and F., Breinl, 1913c (N.Q.).

CENTROPUS PHASIANUS, Lath. (Coulal, pheasant cuckoo).

*b. Echinostoma emollitum*, Nicoll, 1914b (N.Q.).

## PASSERIFORMES.

PITTA STREPITANS, Temin (noisy Pitta).

*d. Microfilaria* sp., Breinl, 1913d (N.Q.).

MICRÆCA FASCINANS, Lath (brown flycatcher).

*a. Trypanosoma anellobiæ*, Clel. and Jnstn., 1911e (S.Q.).

It probably belongs to a different species.

*Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.)

*b. Echinostoma* sp., Jnstn., 1912c. (S.Q.).

MYIAGRA RUBEOLA, Lath. (leaden flycatcher).

*d. Filaria* sp., Bancroft, 1889 (S.Q.).

CORACINA ROBUSTA, Lath. (blue jay; cuckoo shrike).

*d. Filaria* sp. Jnstn., 1912c (Burnett R.)

PSOPHODES CREPITANS, Lath. (coachwhip).

*d Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

POMATOSTOMUS FRIVOLUS, Lath (babbler, twelve apostles).

*d Filaria* sp., Bancroft, 1889 (S.Q.).

MEGALURUS GRAMINEUS, Gould (grass bird).

*a Hæmoproteus danilewskyi*, G. and F., Breinl, 1913c.  
(N.Q.).

ARTAMUS LEUCOGASTER, Val. (white-breasted wood swallow).

*d Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

ARTAMUS TENEBROSUS, Lath. (brown wood swallow).

*d Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

GRALLINA PICATA, Lath. (peewit).

*a Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).

*d Echinorhynchus* sp., Jnstn., 1912c, 1914 (N.Q.).

GYMNORHINA TIBICEN, Lath. (magpie).

*d Filaria* spp., Bancroft, 1889 (S.Q.).

*Filaria clelandi*, Jnstn., 1912b. (S.Q.).

CRATICUS NIGRIGULARIS, Gould (black-throated butcher bird).

*d Filaria* sp., Clel. and Jnstn., 1911c (Gladstone).

CRATICUS DESTRUCTOR, Temm. (the butcher bird).

*a Hæmoproteus danilewskyi*, G. and F., Breinl, 1913c  
(N.Q.).

*d Filaria* sp., Bancroft, 1889 (S.Q.).

PACHYCEPHALA RUFIVENTRIS, Lath. (rufous-breasted thickhead).

*c Sphærouterina punctata*, Jnstn., 1914c (S.Q.).

ZOSTEROPS CAERULESCENS, Lath. (silver-eye).

*a Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).

PARDALOTUS MELANOCEPHALUS, Gould (black headed pardalote).

*a Hæmoproteus* sp., Clel. and Jnstn., 1911c; Clel., 1915b  
(S.Q.).

\* *Leucocytozoon anellobiae*, Jnstn., Clel. and Jnstn., 1911c (S.Q.).

\* *Trypanosoma anellobiae*, Clel. and Jnstn., 1911c (S.Q.).

d *Microfilaria* sp., Clel. and Jnstn., 1911c (S.Q.).

PLECTORHAMPHUS LANCEOLATUS, Gould (striped honey-eater).

d *Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

MYZOMELA SANGUINEOLENTA. Lath. (blood-bird).

a *Trypanosoma* sp., probably *Tr. anellobiae*; Clel. 1915b (S.Q.).

*Hæmoproteus* sp., Clel. and Jnstn., 1911c; Clel., 1915b (S.Q.).

*Leucocytozoon anellobiae*, Jnstn., Clel. and Jnstn., 1911c; Clel., 1915b (S.Q.).

d *Filaria* sp., Clel. and Jnstn., 1911c; Clel., 1915b (S.Q.).

CONOPOPHILA ALBIGULARIS, Gould (white-throated honey-eater).

c *Davainea conopophilæ*, Jnstn., 1913 (N.Q.).

STIGMATOPS OCULARIS, Gould (a brown honey-eater).

d *Filaria* sp., Clel. and Jnstn., 1911c (Gladstone).

PTILOTIUS FUSCA, Gould (a brown honey-eater).

a *Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).

*Trypanosoma anellobiae*, Clel. and Jnstn., 1911c (S.Q.).

\*Two fairly distinct types of trypanosomes have been recorded by Dr. Cleland and myself (1911c) from Queensland birds viz., a broad type occurring in *Micræca* and *Pardalotus* and a narrower one found especially in the Meliphagidæ (honey-eaters). though in this family both are sometimes met with. Intermediate forms have been seen by us. Danilewsky found the same differences elsewhere in regard to his *Tryp. avium* with which Dr. Breinl (1915) has since identified some parasites from Northern Queensland birds. Though we included all our Trypanosomes from birds under the name *T. anellobiae*, it is quite likely that there may be slight morphological or physiological differences of specific value. The same remark holds good regarding *Leucocytozoon anellobiae*, which we have recorded from a considerable number of Queensland birds. It should be mentioned that Dr. Cleland believes that this last named parasite is an intracorpuseular phase of a trypanosome ("Australian Hæmatozoa," Med. Jour. Austr., 1914, 1., p. 240).

*Leucocytozoon anellobiæ*, Jnstn., Clel. and Jnstn., 1911c (S.Q.).

*d Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

MYZANTHA GARRULA, Lath. (soldier bird; noisy minah).

*a Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).

*Leucocytozoon anellobiæ*, Jnstn., Clel. and Jnstn., 1911c (S.Q.).

*d Filaria* sp., Bancroft, 1889; Clel. and Jnstn., 1911c (S.Q.).

ANELLOBIA CHRYSOPTERA, Lath. (brush wattie bird)

*a Trypanosoma anellobiæ*, Clel. and Jnstn., 1911c, 1912a (S.Q.).

*Hæmoproteus danilewskyi*, Breinl, 1913c (N.Q.).

*Leucocytozoon anellobiæ*, Jnstn., 1912c, Clel. and Jnstn., 1911c (S.Q.).

*d Filaria* sp., Bancroft, 1889; Jnstn., 1910g; Clel. and Jnstn., 1910d, 1912c (S.Q.).

ANELLOBIA LUNULATA, Gould.

The parasites listed by Bancroft (1890a), and by me (1910g) under this host belong to the preceding host species.

ENTOMYZA CYANOTIS, Lath. (blue-faced honey-eater).

*a Trypanosoma anellobiæ*, Clel. and Jnstn., 1911c (S.Q.).

*Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).

*Leucocytozoon anellobiæ*, Jnstn., Clel. and Jnstn., 1911c (S.Q.).

*c Davainea conopophilæ*, Jnstn., 1913 (N.Q.).

*d Filaria* sp., Bancroft, 1889 (S.Q.); Clel. and Jnstn., 1911c (Gladstone, Burnett R.).

TROPIDORHYNCHUS CORNICULATUS, Lath. (friar bird),

*a Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).  
leatherhead).

*Leucocytozoon* sp., Breinl, 1913c (N.Q.) is probably  
*L. anellobiæ*—Jnstn., 1916.

PHILEMON CITREIGULARIS, Gould (yellow-throated friar bird).

*c Davainea conopophilæ*, Jnstn., 1913 (N.Q.).

*d Filaria* sp., Jnstn., 1912b (S.Q.).

**ORIOLOUS SAGITTARIUS**, Lath. (the oriole).

- a Trypanosoma anellobiæ*, Clel. and Jnstn., 1911c (S.Q.).  
*Leucocytozoon anellobiæ*, Jnstn., Clel. and Jnstn.,  
 1911c (S.Q.).

*Hæmoproteus* sp., Clel. and Jnstn., 1911c (S.Q.).

- d Filaria* sp., Bancroft, 1889a. Clel. and Jnstn., 1911c  
 (S.Q.).

**SPHECOTHERES MAXILLARIS**, Lath. (tig bird).

- a Leucocytozoon anellobiæ*, Jnstn., Clel. and Jnstn.,  
 1911c (S.Q.).

*c Davainea sphecotheridis*, Jnstn., 1914 (N.Q., Burnett R.).

**CHIBIA (DICRURA) BRACTEATA**, Gould.

- a Hæmoproteus danilewskyi*, G. and F., Breinl, 1913c  
 (N.Q.).

*b Lepoderma nisbetii*, Nicoll, 1914a (N.Q.).

*Prosthogonimus vitellatus*, Nicoll, 1914a (N.Q.).

- d Filaria* sp., Bancroft, 1889 (S.Q.).

**CHLAMYDODERA ORIENTALIS**, Gould (Queensland bower bird).

- a Trypanosoma chlamydoderæ*, Breinl, 1913c (N.Q.).

*Hæmoproteus danilewskyi*, G. and F., Breinl, 1913c  
 (N.Q.).

**SERICULUS CHRYSOCEPHALUS**, Lewin (regent bird).

- d Filaria* sp., Bancroft, 1890a (S.Q.).

**CRASPEDOPHORA ALBERTI**, Elliot (Cape York rifle bird)

- c Binterina clavulus*, Linstow, 1888 (Cape York).

**\*CORVUS CORONOIDES**, V. and H.

- d Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

**\*CORONE AUSTRALIS**, Gould.

- d Filaria* sp., Bancroft, 1889 (S.Q.).

**STREPERA GRACULINA**, White (pied Crowshrike; crow magpie).

- d Filaria* sp., Bancroft, 1889 (S.Q.).

**STRUTHIDEA CINEREA**, Gould (grey jumper; happy family).

- d Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

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\*See "*Emu*," xii, July, 1912, p. 44, regarding the confusion in the nomenclature of these two birds, as to which is the crow and which the raven.

**CORCORAX MELANORHAMPHUS**, Vieill. (chough ; mutton bird).

*a* ? *Trypanosoma* sp., Clel. and Jnstn., 1911c (S.Q.).

*Leucocytozoon anellobieæ*, Jnstn., Clel. and Jnstn., 1911c (S.Q.).

*d* *Filaria* sp., Clel. and Jnstn., 1911c (S.Q.).

## REPTILIA.

### CHELONIA.

**CHELODINA LONGICOLLIS**, Shaw (long-necked tortoise).

*a* *Trypanosoma chelodina*, Johnson, J. and C., 1911a (Burnett); Breinl, 1913c (N.Q.).

*Hæmogregarina clelandi*, Jnstn\*, Jnstn. and Clel., 1911a; C. and J., 1912a (Burnett); Breinl, 1913c (N.Q.).

**CHELODINA EXPANSA**, Gray (lagoon tortoise).

*a* *Hæmogregarines*, Plimmer, 1915 (Q.) —almost certainly = *H. clelandi*, Jnstn.

**EMYDURA KREFFTHI**, Gray (Kreffth's tortoise).

*a* *Trypanosoma chelodina*, Johnson, J. and C., 1911a (S.Q.)

*Hæmogregarina clelandi*, Jnstn., J. and C., 1911a (S.Q.).

**EMYDURA LATISTERNUM**, Gray.

*b* *Aptorchis æqualis*, Nicoll, 1914a (N.Q.).

**EMYDURA MACQUARLÆ**, Gray.

*a* *Trypanosoma chelodina*, Jnstn., 1911f (S.Q.).

*Hæmogregarina clelandi*, Jnstn., Jnstn., 1911f (S.Q.)

*Hæmocystidium chelodinæ*, J. and C., Jnstn., 1911f (S.Q.).

These three Hæmoprotozoa were listed under *Emydura Kreffthi* by Johnston and Cleland, 1910c; C. and J., 1912a.

**ELSEYA DENTATA**, Gray.

*b* *Amphistoma* sp., Krefft, 1871 (N.Q.).

*d* *Ascaris* sp., Krefft, 1871 (N.Q.).

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\* *Hæmogr. dentata*, Lewis (Bull. North Territory, 8, 1913, p. 34), from *Elseya dentata*, from Darwin, is probably a synonym.

## CHELONIA MYDAS, Linn. (green turtle).

*b Amphistoma scleroporum*, Crepi., Jnstn., 1911*f* (Masthead I.).

*Octangium sagitta*, Looss., Jnstn., 1911*f* (Masthead I.); S. J. Jnstn. 1913 (N.Q.).

*Polyangium linguatula*, S. J. Jnstn., 1913 (N.Q.).

*Diaschistorchis pandus*, Braun., S. J. Jnstn., 1913 (N.Q.).

## LACERTILIA.

VARANUS VARIUS, Shaw (lace lizard, monitor, common tree "goanna.")

*a Hæmogregarina\* varanicola*, J. and C., 1911*a* (S.Q.); C. and J., 1912*a* (S.Q.); Breinl, 1913*c* (N.Q.).

*b Sparganum* sp., Jnstn., 1911*f* (S.Q.), Nicoll, 1914*d* (N.Q.).

*Acanthotænia tidswelli*, Jnstn., 1913 (N.Q.).

*Acanthotænia* sp. (plerocercoid), Jnstn., 1914 (N.Q.).

*Bothridium parvum*, Jnstn., 1913 (N.Q.).

*d Physaloptera varani* ? Jnstn., 1916 (S.Q.).

VARANUS BELLII, D. and B. (perhaps only a well-marked variety of the last-named monitor).-

*a Hæmogregarina varanicola*, J. and C., Jnstn., 1912*b* (S.Q.).

*c Acanthotænia tidswelli*, Jnstn., 1912*b* (S.Q.).

*d Physaloptera varani* ? Jnstn., 1912*b* (S.Q.).

VARANUS GOULDII, Gray (Gould's monitor; sand "goanna").

*a Hæmogregarina gouldii*, J. and C., 1911*a* (S.Q.).

*c Acanthotænia tidswelli*, Jnstn., 1911*f* (S.Q.).

*Sparganum* sp., Jnstn., 1911*f* (S.Q.).

*d Physaloptera varani* ? St., Jnstn., 1911*f* (S.Q.).

PHYSIGNATHUS LESUEURI, Gray (water lizard, water dragon).

*d Filaria physignathi*. Jnstn., 1912*b*; J. and C., 1911*a* (S.Q.).

CHLAMYDOSAURUS KINGII, Gray (frilled lizard).

*c Sparganum* sp., Jnstn., 1914 (N.Q.); 1916*a* (S.Q.).

*d Filaria chlamydosauri*, Breinl, 1913*d* (N.Q.).

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\* The hæmogregarines of lizards and snakes are often placed under the subgenus (or genus) *Karyolysus*

LYGOSOMA (HINULIA) TÆNIOLATUM, White (a skink).

*a Trypanosoma* sp., J. and C., 1911a (S.Q.)

*Hæmogregarina* sp., J. and C., 1911a (S.Q.).

TILIQUA SCINCOIDES, White (blue-tongued lizard).

*b Mesocælium microon*, Nicoll, 1914a (N.Q.).

*Tetracotyle tiliquæ*, Nicoll, 1914a (N.Q.).

*d* lung nematodes--described and figured by Breinl, 1913d (N.Q.). I have met with the same species in this host in Sydney district (N.S. Wales), and in the vicinity of Brisbane. The parasite was not named by Dr. Breinl, who, however, drew attention to certain anatomical peculiarities of the nematode, and thought that it belonged to a new genus. As a result of an examination of my specimens, I agree with him. It is proposed to name the parasite *Pneumonema tiliquæ* n. gen., n. sp. I hope to be able to definitely classify it later.

OEDURA TRYONI, DE VIS (Tryon's gecko).

*a Hæmogregarina* sp., Jnstn., 1911f (Burnett R.).

*Hæmocystidium* sp., Jnstn. 1911f (Burnett R.).

LIALIS BURTONII, Gray (Burton's slow worm).

*c Acanthotænia striata*, Jnstn., 1914 (N.Q.).

DELMA FRAZERI, Gray (Frazer's slow worm).

*b Eurytrema crucifer*, Nicoll, 1914a (N.Q.).

## OPHIDIA.

PYTHON AMETHYSTINUS, Schn. (Northern Queensland carpet snake).

*a Hæmogregarina amethystina*, Jnstn., 1909b, 1910a (Port Curtis).

= *H. pythonis*, Bill., Jnstn., 1911f.

PYTHON SPILOTES var. VARIEGATUS, Gray (the common carpet snake).

*a Hæmogregarina shattocki*, Lamb., Jnstn., 1909d, 1910a (Brisbane); J. and C., 1911a; C. and J., 1912a (Burnett); = *H. pythonis*, Billet—Jnstn., 1911f.

*b Dolichopera parvula*, Nicoll, 1914a (N.Q.).

*c Sparganum* sp., Jnstn., 1911f. (S.Q.).

*Acanthotænia* sp., Jnstn., 1914 (N.Q.)

*d Ascaris* sp., Jnstn., 1911f (S.Q.).

**ASPIDIOTES RAMSAYI**, Macleay (a western python).

*c* *Ophiolaenia longmani*. Jnstn., 1916a (W.Q.).

*d* *Ascaris* sp., Jnstn., 1916a (W.Q.).

*e* *Porocephalus* sp., Jnstn., 1916a (W.Q.).

**DENDROPHIS PUNCTULATUS**, Gray (green tree-snake).

*a* *Hæmogregarina dendrophidis*\*, J. and C., 1910c;  
C. and J., 1912a (S.Q.).

*c* *Sparganum* sp., Jnstn., 1911f (S.Q.).

**DIPSADOMORPHUS FUSCUS**, Gray (brown tree-snake).

*a* *Hæmogregarina* sp., Breinl, 1913c (N.Q.).

*d* *Agamonema* sp., (larval-encysted)—Brisbane, (Coll.  
H. A. Longman), Jnstn., 1916c.

*Echinorhynchus* sp. (larval-encysted)—Brisbane (Coll.  
H. A. Longman), Jnstn., 1916c.

**FURINA OCCIPITALIS**, D. and B. (ringed snake).

*d* *Diaphanocephalus* sp., Jnstn., 1911f (S.Q.).

**DIEMENIA TEXTILIS**, D. and B. (brown snake).

*a* *Trypanosoma* sp., Tyrie and Love, 1906 (N.Q.).

*c* *Sparganum* sp., Jnstn., 1913 (N.Q.).

*d* *Echinorhynchus* sp., Jnstn., 1916—larvæ forms in  
peritoneum and mesenteries (Brisbane).

**PSEUDECHIS AUSTRALIS**, Gray (a black snake).

*a* *Hæmogregarina bancrofti*, J. and C., 1911a; C. and J.,  
1912a (S.Q.).

*c* *Sparganum* sp., Jnstn., 1911f (S.Q.).

*Acanthotænia gallardi*, Jnstn., 1911f; 1912b (S.Q.).

**PSEUDECHIS MORETONENSIS**, De Vis (orange-ocellied brown  
snake).

*a* *Hæmogregarina bancrofti*, J. and C., 1911a (S.Q.).

## AMPHIBIA.

**HYLA CÆRULEA**, White (the common green frog).

*a* *Hæmogregarina* (*Lankesterella*) *hyla*, C. and J., Clcl.,  
1915a (Burnett R.)—very common in Brisbane  
district (Jnstn., 1916).

*Balantidium*, sp.—apparently uncommon (Brisbane).

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\* *Hæm. calligasger*, Lewis, l.c., p. 34, from *Dendrophis calligasger* (a misprint for *calligaster*) from the Northern Territory is apparently a synonym; whilst his *H. darwinensis* from *Pseudechis darwinensis* (p. 34), looks like *H. pseudechis*, Jnstn. P.L.S., N.S.W., 34, 1909, p. 406.

*Nyctotherus* spp.—common (Brisbane).

*Opalina* spp.—common (Brisbane).

*Amœba* sp., aff. *A. limax* (Brisbane).

*Trichomastix* sp. (Brisbane).

*b Mesocœlium microon*, Nicoll, 1914*a* (N.Q.).

*Mesocœlium mesembrinum*, S.J.J., Jnstn., 1916*c* (Brisbane).

*Dolichosaccus ischyryus*, S.J.J., Jnstn., 1914*b* (Brisbane).

*Diplodiscus megalochrus*, S.J.J., Jnstn., 1916*c* (Brisbane). Now recorded from this host for the first time.

*c Sparganum* spp. (at least two types), Jnstn., 1911*f* (Burnett R.); 1912*b* (S.Q.).

*d Agamonema* sp., Jnstn., 1914*c* (Brisbane).

*Rhabdonema* sp. (lung worm), Jnstn., 1916*c* (Brisbane).

*Echinorhynchus hylæ*, Jnstn., 1914*c* (Brisbane).

#### HYLA GRACILENTA, Peters.

*b Mesocœlium microon*, Nicoll, 1914*a* (N.Q.).

#### HYLA LESUEURII, D. and B.

*a Trypanosoma* sp., Bancroft in Clel. and Jnstn., 1910*c* (Brisbane).

#### HYLA NASUTA, Gray.

*a Trypanosoma* sp., Bancroft, 1891, and in Clel. and Jnstn., 1910*c* (Brisbane).

#### LYMNODYNASTES TASMANIENSIS, Gunther.

*a Trypanosoma rotatorium*, Mayer, Clel. and Jnstn., 1910*c*; 1912*a* (S.Q.).

I now consider that [this species should be separated from the European one, and suggest that it be associated with the name of my former colleague in parasitological work, Dr. J. B. Cleland=*Trypanosoma clelandi*, Jnstn., nom. nov.

#### LYMNODYNASTES ORNATUS, Gray (?).

*a Trypanosoma rotatorium*, Mayer, C. and J., 1910*c*; 1912*a* (S.Q.)=*Tryp. clelandi*, Jnstn., 1916 (see above).

## PISCES.

## ELASMOBRANCHII.

**DASYBATHIS KUHLLI**, M. and H. (spotted ray).

*b* *Petalodistomum polycladum*, S. J. Jnstn., 1913 (N.Q.).

*Petalodistomum cymatodes*, S. J. Jnstn., 1913 (N.Q.).

## TELEOSTEI.

**COPIDOGLANIS (TANDANUS) TANDANUS**, Mitchell (fresh-water catfish).

*a* *Trypanosoma bancrofti*, J. and C., 1910*b*; C. and J., 1912*a* (S.Q.)

*b* *Isoparorchis* sp., Jnstn., 1914*b* (Condamine R.).

I have since received many specimens taken from the swim bladder of this host from the Burnett River (Eidsvold), and the Dee River, by Dr. T. L. Bancroft.

**ANGUILLA MAURITANA**, Bennett (marbled eel).

*a* *Trypanosoma anquillicola*, J. and C., 1910*b*; C. and J., 1912*a* (Burnett R.).

**ANGUILLA REINHARDTII**, Steind (long finned eel).

*a* *Trypanosoma anquillicola*, J. and C., 1910*b*; C. and J., 1912*a* (S.Q.).

**EELS**:—Nicoll, 1914*d* mentions the occurrence of *Filariae* in the body cavity (N.Q.).

**MURÆNESOX CINEREUS**, Forsk. (Pike eel).

*b* *Ectenurus angusticanda*, Nicoll, 1915*a* (N.Q.).

**SAURIDA UNDOsquAMIS**, Richdsn. (the grinner, lizard fish).

*Tetrarhynchus* (larval) from mesentery, Jnstn., 1916 (Moreton Bay).

**SERIOLA LALANDI**, Cuv. and Val.—according to Mr. Ogilby, the fish referred to should be called *S. grandis*, Cast.—king fish).

*c* *Tetrarhynchus (Anthocephalus)* sp., Jnstn., 1914*a* (N.Q.); 1916*c* (Masthead I.)

*d* *Filaria*, Nicoll, 1914*d* (N.Q.).

**CARANX NOBILIS**, Macleay (= *C. georgianus*, C. and V., according to Mr. J. D. Ogilby—white trevally).

*Bucephalopsis exilis*, Nicoll, 1915*a* (N.Q.).

POMADASIS HASTA, Bloch (Javelin fish).

- b* *Æphnidiogenes barbarus*, Nicoll, 1915a (N.Q.).
- Genolopa trifolifer*, Nicoll, 1915a (N.Q.).
- Genolopa cacuminata*, Nicoll, 1915a (N.Q.).
- Sterrhurus brevicirrus*, Nicoll, 1915a (N.Q.).

SPARUS BERDA Forsk (syn. *Chrysophrys hasta* Bl., a sea bream).

- c* *Tetrarhynchus* (*Anthocephalus*) sp., Jnstn., 1914a (N.Q.).

SPARUS AUSTRALIS, Gunther (black bream).

- b* *Coitocæcum gymnophallum*, Nicoll, 1915a (N.Q.).
- Xenopera insolita*, Nicoll, 1915a (N.Q.).
- d* *Echinorhynch*:—Nicoll, 1914d (N.Q.).
- Filaria* sp., peritoneum, Jnstn., 1916 (Moreton Bay).

TACHYSURUS sp. (pilot fish).

- b* *Gyliauchen tarachodes*, Nicoll, 1915a (N.Q.).

SPHÆROIDES LUNARIS, Schn. (a toadfish).

- b* *Opistholebes amplicælus*, Nicoll, 1915a (N.Q.).

SPHÆROIDES MULTISTRIATUS, Richdsn. (spotted toadfish).

- b* *Maculifer subæquiporus*, Nicoll, 1915a (N.Q.).

TETRAODON HISPIDUM var. (spotted toadfish).

- b* *Steringotrema pulchrum*, S. J. Jnstn., 1913 (N.Q.).

TETRAODON HISPIDUM, L.

- b* *Steringotrema pulchrum*, S. J. Jnstn., 1913 (N.Q.).

TOADFISHES.

Nicoll (1914d) refers to the presence of filariæ in the body cavity (N.Q.).

## DIPNOI.

CERATODUS (NEOCERATODUS) FORSTERI, Krefft. (Ceratodus, Queensland lung fish, Burnett River salmon).

- b* *Amphistoma* sp., Jnstn., 1912b (Burnett R.).
- d* *Amblyonema terdentatum*, Linstow, 1898; Jnstn., 1912b (Burnett R.).

*Ascaris* sp., Krefft., 1871, is almost certainly the same as the preceding species.

## ARTHROPODA.

## ARACHNIDA (ACARIDA)

ARGAS PERSICUS Wald. (Syn. A. AMERICANA Pack.)—(the fowl tick).

- a. *Spirochaete (Spiroschaudinnia) gallinarum* the parasite of fowl tick-fever. Dodd 1909 (N.Q.).—(see also under "Fowl" (GALLUS DOMESTICUS).)

BOOPHILUS AUSTRALIS, Fuller (*the cattle tick*)

- a *Babesia bigeminum*, K. and S., the correct name is probably *B. bovis*, though the organism is generally known in Queensland as *Piroplasma bigeminum*, the cattle tick-fever parasite. For general references to this hæmatozoon, see under "Ox."

BOOPHILUS ANNULATUS var., MICROPLUS, Canestr. (*cattle tick*).

- a *Babesia bigeminum*, Kilb. and Smith; Gilruth, 1912 (Qld.).

APONOMMA TRIMACULATUM, Lucas.

- a *Hæmogregarina varanicola*, J. and C., in intestine, and probably transmitted by this tick; Breinl, 1913c (N.Q.).

APONOMMA spp.

The various hæmatozoa of lizards and snakes are no doubt transmitted mainly by species of *Aponomma*, which are common on these hosts in this State, and are found occasionally on mammals.

## INSECTA.

## ORTHOPTERA.

PERIPLANETA AMERICANA, L. (*the introduced house cockroach*).

- d *Oxyuris* sp., Jnstn., 1916c (Brisbane).

PERIPLANETA AUSTRALASIE, Fabr. (*house cockroach*).

- a *Nyctotherus* sp., found by Mr. C. D. Gillies and myself (Brisbane).

- d *Oxyuris* sp., Jnstn., 1916c (Brisbane).

## COLEOPTERA.

CACACHROA DECORTICATA, Macleay (*a cane beetle*).

- d *Thelastomum alatum*. Jnstn., 1914c (Cairns)

## APHANIPTERA

The presence of the cysticeroid stage of *Dipylidium caninum* L. (a tapeworm, which infests cats and dogs in Queensland) in the cat flea and dog flea (*Ctenocephalus felis* and *C. canis* respectively), may be inferred. Likewise also the cysticeroid of *Hymenolepis diminuta* of rats, in *Ceratophyllus fasciatus*, one of the rat fleas. The lastnamed ectozoon is also known to be the chief transmitter of *Trypanosoma lewisi*, which is a blood parasite of local rats.

## DIPTERA.

**MUSCA DOMESTICA** L. (common house fly).

*a Leptomonas (Herpetomonas) muscæ-domesticæ*, Burnett, Jnstn., 1916c (Brisbane, also in Sydney, N.S.W.).

*d Habronema muscæ*, Carter; Jnstn., 1912b (Brisbane).

**MUSCA VETUSTISSIMA**, Walker (cattle fly).

*d Habronema muscæ*, Carter? Jnstn., 1912b (S.Q.).

*Habronema* sp., Tryon, 1914, the same as the preceding.

**CALLIPHORA OCEANICÆ**, Desv. (a common blow fly).

*a Leptomonas (Herpetomonas) muscæ-domesticæ*, Burnett, Jnstn., 1916c (Brisbane).

According to Dr. Cleland (Trans. Int. Med. Congr. Austr. 1913, p. 566), the correct name of the blow-fly known here as *C. oceanica* is *Anastellorhina augur* Fabr.

**CALLIPHORA VILLOSA**, Desv. (a blow-fly).

*a Leptomonas (Herpetomonas) muscæ-domesticæ*, Burnett, Jnstn., 1916c (Brisbane).

According to Dr. Cleland (*l.c.*, p. 550), the blow-fly identified as *C. villosa* is really *Pollenia stygia*, Fabr.

**CULEX FATIGANS**, Wied. (syn *C. skusii*, Giles), common house mosquito.

The organism of *dengue* is transmitted by this mosquito.

*Dirofilaria immitis*, Leidy (heart worm of the dog).\*

Bancroft, 1893, 1898, 1900, 1901a, 1903a, 1903b.

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\*Dr. G. Sweet (1908, p. 485), has misquoted Bancroft, 1901a, in reference to *Anopheles maculipennis* as the intermediate host of *Dirofilaria immitis* in Queensland. Bancroft states definitely (p. 43, 1901), that this mosquito does not occur in Australia (1903, p. 251).

*Filaria bancrofti*, Cobbold (human), Bancroft. 1903a.  
 CULEX CILIARIS, Skuse, nec Linn=*C. fatigans*.

*Filaria bancrofti* Cobb., Bancroft, 1893. 1899a. 1899b.  
 CULICELSA ANNULIROSTRIS, Skuse.

*Filaria bancrofti*, Cobbold, Bancroft, 1899a.  
 SCUTOMYIA NOTOSCRIPTA, Skuse.

*Filaria bancrofti*, Cobb., Bancroft, 1899a. O'Brien (1908) believes this mosquito to be the carrier of dengue in North Queensland.

CULICELSA VIGILAX, Skuse—the black bush mosquito.

*Filaria bancrofti*, Cobb., Bancroft. 1893.

As far as I am aware, no work other than that of Dr. T. L. Bancroft has been published regarding the transmission of parasites by mosquitoes in Australia. Human malaria is transmitted by Anophelines; Castellani and Chalmers (Man. Trop. Med., p. 354), mention, however, but on what authority I do not know, that *Nyssorhynchus* (= *Anopheles*) *annulipes*, Walker, is known to be a carrier in Australia. This mosquito which occurs in Australia\* has been proved by Kinoshita† to be a transmitter in Formosa.

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\*T. L. Bancroft. List of the mosquitoes of Queensland. Ann. Queensland Museum, No. 8, 1908; J. B. Cleland. List of the mosquitoes recorded in Australia. Rep. Bur. Microbiol. N.S.W. (1910-11), 2, 1912, pp. 143-5., and in Trans. Intercol. Med. Congr. Austr. 9 (1), 1911 (1913), pp. 553-5; F. Taylor. Descriptions of mosquitoes collected in the Northern Territory during the expeditions of 1911. Bull. North Territory, No. 1a, 1912, pp. 25-34; A. Breinl, 1912, p. 18, 23; L. Cooling, Report on mosquito work in Brisbane, in Rep. Commiss. Public Health, Queensland, 1914, pp. 56-64; E. Ferguson. Notes on mosquitoes, Ann. Rep. Govt. Bur. Microbiology, N.S.W., 4, 1915, p. 238.

A. Breinl and M. J. Holmes in their "Medical Report on the data collected during a journey through some districts of the Northern Territory" (Bull. North. Terr., No. 15, Dec., 1915) state that "the mosquito which in all probability carries the malarial parasite in N.T. is *Nyssorhynchus annulipes*. . ." (p. 5.).

Since writing the above I have come across a reference by Breinl (1915) who in writing of this mosquito calls it the carrier of malaria. This statement is not based on experiment, but only on general grounds. As far as I am aware no species of mosquito has yet been proved to be a carrier of any form of malaria parasite, *Plasmodium*, *Proteosoma*, *Hæmoproteus*, etc., in Australia.

†Kinoshita. Arch. F. Schiffs, u. Tropenbyg, 10, p. 708. This reference, as well as some that follow, have been kindly supplied by Mr. F. H. Taylor, of the Tropical Institute, Townsville.

## MOSQUITOES.

Bird malaria, *Plasmodium* (*Proteosoma*) spp. is transmitted elsewhere, as far as known, by species of culicine mosquitoes (Minchin. *Intn. Study Protozoa*, 1912, p. 358), including *Stegomyia fasciata* (p. 364) (= *S. calopus*), which is common in Eastern Queensland.

In reference to *Halteridum* (*Hæmoproteus*), which is so common in Queensland birds, Minchin states (*l.c.*, p. 357), that the invertebrate host, so far as known, is a Hippoboscoid fly, but as these are very uncommon on our native birds, especially the passerines, one is led to believe that in Australia, at least, some other group of Diptera must act as transmitters, *e.g.*, some mosquito, probably a Culicine.

In regard to the reptilian *Hæmocystium* parasites, the carrier in the case of the tortoises is no doubt a freshwater leech, some of which occur ectoparasitically on Queensland species of *Chelodina* and *Emydura*, whilst in the case of lizards it may be a mosquito, or perhaps a tick.

Dr. Bancroft did good work in tracing the life history of the filarial worm, with which his father's name is associated (*F. bancrofti*, Cobbold). Theobald has given a formidable list of mosquitoes both Culicine and Anopheline which can act as transmitters. (Castellani and Chalmers *Man. Trop. Med.*, p. 666, 1126). Amongst them are some occurring in Queensland, *e.g.*, *Tæniorhynchus* (*Mansonia*, *Mansonoides*), *uniformis*, Theob.; *Anopheles annulipes*, etc. Perhaps *Stegomyia calopus* (*S. fasciata*) may also do so,\* since *S. pseudoscutellaris*, Theob., is a transmitter in Fiji† and probably also in New Guinea, where it occurs too (Brienl, 1915).

*Dirofilaria immitis* is carried by *Anopheles* sp. in Europe (Manson, *Trop. Diseases*, p. 564). Bancroft has found that at least one Culicine species, *C. fatigans* (*C. skusii*) can transmit it in Queensland.

We do not yet know the carriers (probably mosquitoes) of the various species of filarial worms so commonly parasitic in Queensland birds, and to a much less extent, in marsupials.

\*Theobald. *Monogr. Culicidæ of the World*, 1, p. 293, quotes this as a host.

†Bahr. *Filariasis*, etc., in Fiji.

*Stegomyia fasciata* (syn. *S. calopus*) is perhaps a transmitter of dengue (Manson. Edit 5, 1914, p. 272).

#### HEMIPTERA.

Amongst the Hemiptera, the rat louse, *Hæmatopinus* (*Polyplax*) *spinulosus*, is known\* to be a carrier of *Trypanosoma lewisi*, Kent, which parasitises the blood of rats in Australia and elsewhere.

#### MOLLUSCA.

Amongst the molluscs, various developmental stages of Trematodes and Cestodes must occur, but their presence has not been reported.

#### ANNULATA.

Leeches, no doubt, serve as intermediate hosts of the Trypanosomes, Hæmogregarines and Hæmocystidium occurring in fresh water tortoises and the trypanosomes of our eels, catfishes and frogs.

*Hæmogregarina* (*Lankesterella*) *hylæ* of the green frog, *Hyla cærulea*, is probably transmitted by a freshwater leech during the aquatic stage of the host.

Entomostraca certainly serve as the intermediate host of many of the Cestodes infesting our birds. No doubt some of the Oliogochætes do also.

Various Nematomorpha frequent our fresh waters, but none have been described either in the parasitic or in the free living stage except *Parachordodes annulatus*, Linstow, 1906. I have mentioned the presence of *Gordius* sp. (free form) at Montville (T.H.J., P.R.S., Q. 27 (2), 1915, p. iv. Tryon, 1911, p. 73; 1912, p.100, has also referred to its occurrence in several localities (Eudlo, Beaudesert, Rockhampton).

I desire to express my thanks to Messrs. Longman and Ogilby†, of the Queensland Museum, for assistance in regard to the names of some of the hosts.

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# THE ORIGIN OF IRON AND MANGANESE ORE IN BOGS AND STREAMS.

BY W. D. FRANCIS.\*

(*Read before the Royal Society of Queensland, 1st May, 1916.*)

A. D. Hall† in writing on the origin of iron ore in undrained soils has stated that further investigation is required regarding the respective shares of the iron bacteria of Winogradsky, on the one hand, and the purely chemical actions of solution and reduction by organic matter and carbonic acid followed by redeposition on evaporation, on the other, in its formation.

Ehrenberg showed that bog iron ore investigated by him consisted of the remains of algæ.‡ Although it can be shown that his observations are not universally applicable, it is interesting to notice that Ehrenberg ascribed the origin of the ore to organic agencies. Investigations by the writer show that ferruginous and manganiferous material in bogs and streams at Kin Kin, which is a stage in ore formation, is composed very extensively, if not entirely, of micro-organic material, chiefly bacterial. A few algæ, and less frequently protozoa, are also present. Besides numerous cocci and bacilli, long filaments are abundant, which in many cases composed the greater part of the

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\* The author in a separate paper records the observation, in the Kin Kin district, of (1) the presence of a red algaoid plant on rocks in streams in scrub country; and (2) the occurrence of a black manganiferous incrustation in similar positions in cleared country. He considers that the black manganiferous incrustations result in some way from the death and decay, or replacement of the red algaoid plant.—Ed.

† A. D. Hall, "The Soil," 1912, p. 286.

‡ "Student's Lyell," 2nd Edn., 1911, pp. 48-49.

material. These filaments are typical bacteria. They vary in size in their natural state from under  $1\mu$  to as much as  $2.5\mu$  in diameter. Like the cocci and short bacilli, they can be stained with basic aniline dyes such as methylene blue, thionin blue, and basic fuchsin, if the excess of hydrated ferric oxide is first removed by treatment with a series of increasing strengths of dilute hydrochloric acid.

Comparison of unstained and stained preparations indicates that the primary elements of the bacteria are surrounded by a ferruginous sheath which accounts for the comparatively large-sized filaments and their visibility when unstained. Further investigation is required to show the exact number and character of the species represented. A greater or less number of the coccoid and short bacillary forms may prove to be stages in the development or segmentation of the filaments, as similar modifications are known to exist in the bacteria. In fact, numbers of the ferruginous filaments when stained are seen to be segmented into short bacillus-like elements. The long, unbranched filaments, which are the most abundant forms, probably belong to *Leptothrix*. *Crenothrix* also appears to be represented, and some apparently branching forms present probably consist of species of *Cladothrix*. Descriptions and figures of these genera are given by Engler and Prantl\*. An interesting account of bacteria allied both chemically and morphologically to those studied by the writer is given by Conn.† The conclusions outlined there are similar to several of those propounded in this paper.

Dr. T. H. Johnston, in the writer's presence, performed an experiment which showed that the iron present in a sample of the ferruginous material was contained in the organisms. He filtered the material and washed the residue with distilled water. The filtrate and wash water together were tested for iron, but that element was found to be absent. As the original sample was found by examination

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\* "Die natürlichen Pflanzenfamilien, Leipzig, 1900, I., Ia., pp. 35-40.

† Agricultural Bacteriology, Philadelphia, 1901, pp. 62-64.

to be entirely composed of the organisms mentioned above and free from colloidal ferruginous material, it is evident that the organisms contained the iron. This conclusion was made still clearer by passing dilute hydrochloric acid through the residue consisting of the organisms, and then testing the solution with ammonia for iron. The resulting precipitate of hydrated ferric oxide showed that the organisms contained the iron.

When early workers were first acquainted with "iron bacteria" some of them contended that the deposition of ferric hydrate in or upon the organisms was of a mechanical nature; but the views of Winogradsky and others, which regard the process as a physiological one, have been proved, or at least are fairly generally accepted.

The abundance of micro-organisms in ferruginous material in bogs and streams is probably related to the known effect of iron on plant growth, which appears to be stimulated in proportion to the amount of iron present.\*

If observations in different parts of the world substantiate it, the organic interpretation of the origin of the ore should be commendable to reason because the accumulations composing the ore would be attributable to the selective and cumulative functions with which organisms are recognised to be endowed.

The writer wishes to acknowledge his obligation to Drs. T. H. Johnston and H. C. Richards, of the Queensland University, for their generous assistance and useful criticisms.

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\* Peirce, "Plant Physiology," 2nd Edn., 1909, p. 101.

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# THE SUPPOSED ARTIODACTYLE (QUEENSLAND) FOSSILS.\*

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By HEBER A. LONGMAN.

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(Read before the Royal Society of Queensland, 1st May, 1916.)

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In May, 1886, the late C. W. De Vis read a paper before this Society entitled, "A Post-Pliocene Artiodactyle."† Under the name of *Prochærus celer*, he described certain fossil teeth as Artiodactyle, associating them with the peccaries rather than with the true pigs.

Apart from bones of the dingo and fragmentary remains of a few rodents, found in recent deposits, the palæontological record of Australia so far as land mammals is concerned is confined to Marsupials and Monotremes. Although Owen described in 1882 a Proboscidian Mammal (*Nótelephas australis*‡) from the remains of a large tusk said to have been found on the Darling Downs, later comments make it appear most unlikely that the fossil was ever collected in Australia. It is not surprising, therefore, that the affirmation by De Vis of the suilline nature of several teeth aroused considerable interest.

The material consisted of various teeth received from different localities on the Darling Downs, these being unaccompanied by cranial or other bones. The type and associated teeth have been examined, and the writer has come to the following conclusions:—The incisor fossils represent remains from at least two and probably three

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\* Contribution from the Queensland Museum.

† Pr. Roy. Soc. Q'ld., III, 1887, pp. 42-47, pl. 1.

‡ Phil. Trans. Roy. Soc., 1882, 3, p. 777, pl. 51.

distinct animals which are known marsupials; the molar tooth does not present sufficient evidence to warrant its designation as non-marsupial and it has no affinity with the Papuan pig.

This last point is of particular interest. *Prochaerus celer* has apparently been interpreted as evidence of the occurrence in Pleistocene deposits in Queensland of the Papuan *Sus*, and in the Federal Handbook of Australia, published in connection with the visit of the British Association in 1914, the following statement appears on the authority of Prof. David (p. 287). “. . . *Sus papuensis* found its way southward from Papua, as far as Darling Downs, of Queensland.”

Coming to details, it is convenient to deal first with the tooth referred to by De Vis as “a lower incisor, the middle tooth of the left side.” This is undoubtedly a left lower lanian incisor of *Thylacoleo carnifex*, Owen. When *Prochaerus celer* was described it is presumed that no lower jaws of *Thylacoleo* with these incisor teeth in position were available in the Queensland Museum collections. Direct comparison with such specimens now establishes identity. It is somewhat surprising, however, that the similarity was not recognised of the supposed new tooth with the incisors figured by Owen and Krefft. Specimens (unnamed) were even illustrated by Mitchell in 1838.\* Except that it is in a more advanced state of wear, the tooth described and figured by De Vis very closely corresponds in size, contours and in the extent and deposition of enamel with figures 5, 6 and 7, Plate IX, of Owen’s work.†

Six upper incisors are noted by De Vis in his paper, and three of these are figured. Associated with these are eight other specimens, apparently regarded as paratypes. These fourteen incisors exhibit considerable variety, and range from unworn, obviously juvenile, examples, 30 mm. in length, to teeth 58 mm. long. Several of these are identical with the second and third upper incisors in position in the premaxillaries of Nototherian mammals, now in the Queensland Museum, which were secured from fluviatile

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\* Mitchell, Exped. to Aus., II, pl. 32, 1838.

† Fossil Mammals of Australia, 1877.

deposits on the Darling Downs. Some of the specimens accord best with the posterior incisors of *Nototherium mitchelli*; others may be more correctly attributed to the smaller crania described as *Euowenia*.\* De Vis attributed certain Queensland Museum Nototherian specimens to Macleay's "*Zygomaturus trilobus*," the status of which is in dispute, but for purposes of this paper it is not necessary here to raise that question. It is sufficient to say that these upper incisors should not be separated from those of our Nototherian Marsupialia.

The tubercles noted in the original description are more or less prominent in the posterior upper incisors of some of these large marsupials. Examples with the teeth *in situ* show that they are decidedly variable. The approximate position of such incisors and their relation to the lower tusks are well illustrated by a profile photograph (Plate 1) in H. H. Scott's Monograph of *Nototherium tasmanicum*.†

The three examples actually figured by De Vis represent very early stages, but there are intermediate specimens through which relationship may be traced to the more mature teeth. The persistent pulp cavity is most prominent in the juvenile, and is less noticeable in older specimens. The describer noted this cavity as "declaring relationship with the progenitors of the hippopotamus." Several of the upper incisors of our Nototherian specimens exhibit a basal pulp cavity, and, as a matter of fact, the feature is by no means rare in marsupial upper incisors and is well marked in both *Phascolomys* and *Phascolarctus*. A non-functional tooth of *Thylacoleo* figured by Owen‡ shows a similar cavity.

The remaining type material consists of a molar tooth described as "a quinque-tuberculate tooth of a bunodont type, composed of four sub-conical cusps separated by crucial sinuses and supplemented by a post-basal talon of similar form." This presents a problem which cannot

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\* De Vis, Pr. Roy. Soc. Q'ld., IV, 1888 ("Owenia") and Proc. Linn. Soc., N.S.W., VI, (2), 1891, p. 159.

† Tas. Geol. Sur. Rec., No. 4, 1915.

‡ Loc. cit., Pl. VII, fig. 12.

be so clearly resolved. In the first place, the condition of the tooth is so unsatisfactory that some boldness was required to base definite conclusions on it. The tooth has been partly built up, one of the cusps is entirely missing and another is unduly elevated, having been glued into position. This condition is largely shown in the original illustration. It was compared with the last lower molar of Peccary and "less nearly" with the last upper molar of the native pig of Papua. Considered as a posterior molar it has no relationship with the teeth of any known marsupial, but these difficulties almost entirely disappear when it is regarded as a premolar. It certainly shows no sign of the strong transverse ridges which are so typical of the true molar series of our poeophagous mammals, such as *Diprotodon*, *Nototherium* and the Macropodidæ. On the other hand, the premolar in these mammals departs from the bilophodont pattern and in some species is partially bunodont. Its variability has been the subject of considerable dispute, and it is interesting to remember that De Vis himself figured a premolar, attributed to *Zygomaturus trilobus*,\* which is bunodont as regards three of its five cusps. This tooth and the discrepant large premolar of Macleay's type of *Z. trilobus* were commented on by Lydekker,† who considered the possibility of the latter being an abnormality or a deciduous third premolar of *Diprotodon* appearing as a "reversionary instance." When the comparative simplicity of the molar type of *Prochærus celer* is considered in conjunction with the above references, it is by no means probable that it represents a non-marsupial. And it may be definitely stated that this tooth, which was obtained at Sharrow, Darling Downs, has no affinity with the complex molars of the Papuan pig, *Sus papuensis*, Lesson, which is regarded by some authorities as merely a form of the Java species, *S. vittatus*, Muller and Schlegel.‡ Jentink and Miller, however, restrict *S. vittatus* to the Sumatra animal.§

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\* Pr. Roy. Soc. Q'ld, V, 1888, part 3, pl. 2.

† Ann. Mag. Nat. His. (6) III, 1889, p. 149.

‡ M. Bauschke. Arch. Naturges., Berlin, 1911, Bd. 1, heft 1.

§ Pr. U.S. Nat. Mus., XXX, p. 748, 1906.

In his interpretation of these teeth and the suggested alliance with the *Dicotylinae* of South America, De Vis was probably influenced by *a priori* considerations, such as the presence of marsupials in both countries and the large number of fossil peccaries and allies described from American deposits.

At present the danger of basing conclusions on isolated teeth is more generally recognised, and the extreme dental variability of the *Marsupialia* as a whole has been previously emphasised by the writer \*. In connection with the utilisation of specimens from different sources, it may be pointed out that so great an authority as Owen included, in addition to lacertilian remains, "a chelonian skull and tail-sheath, and marsupial foot-bones" in his description of *Megalanias prisca*.†

It should be added that as the domestic pig has now "run wild" in several places in Queensland, its bones will probably be found from time to time in scrub country.

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\* Proc. Roy. Soc. Q'ld., XXVI, 1914, p. 36.

† Woodward, Ann. Mag. Nat. Hist. (6) 1, 1888, p. 88.

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# FURTHER NOTES REGARDING THE KAIVA KUKU AND SEMESE DANCES OF PAPUA.

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By RONALD HAMLYN-HARRIS, D.Sc.

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(*Read before the Royal Society of Queensland, 29th May,  
1916.*)

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Some time ago I contributed a short paper on the ceremonial appurtenances used at Kaiva Kuku and Semese dances in illustration of some material now in the collections of the Queensland Museum,\* but on account of the extreme difficulty in ascertaining information regarding these secret and symbolic dances,† I had to confine my remarks to the information which was available at the time. Since then I have been in communication with various correspondents in Papua and have been successful in obtaining a little more information which I here present as a further contribution to a very difficult subject.

Dr. Strong tells me that the ceremonies take place in the coastal villages of the Papuan Gulf from Oroko on the west to Jokea and Oiyopu (Oiapu) on the east. These are villages speaking closely related languages and forming a clear ethnic group. A similar form of decorative art is found in the villages of Purari further to the west, but in language and customs these are clearly cut off from the Gulf natives proper. Dr. Strong is not sure whether they have true Kaiva Kuku or Semese customs

On the east the decorative art (together with the bow and arrow) was just beginning to enter the Mekeo and coastal Mekeo or Roro villages. Remarkable customs were

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\* *Memoirs Q'land Museum*, Vol. 2, 1913, p. 9.

† H. H. Romilly, "From my Verandah in N.G., 1889," p. 88.

also known in the coastal villages of Kevori and Maiva. Traces of the decorative art are also found in the Aipiana and Siria, Yule Island, as well as the two villages of Kevin and Mowa and perhaps others. It has been pointed out by Chalmers,\* amongst others, that the Kaiva Kuku ceremonies are essentially tabu.

The men, *i.e.*, chiefs of the various sections of the village decide that the coconuts shall not be eaten until a certain time, *e.g.*, in preparation for a feast. The "expert" in the matter of coconut growing dresses up in one of the Kaiva Kuku masks and parades the village and erects a few stacks with portions of coconut shells or other odds and ends suspended from them, *e.g.*, grass streamers and boards with markings on them.† Gardens in like manner may be tabooed; a breach of the tabu renders the culprit liable to punishment by the appropriate "expert," who keeps a wretch and deals out punishment, dressed up in a mask and disguised with a species of grass dress. Probably the real force of the tabu depends on magic, since it is generally sufficient from the native point of view to get sand out of a footprint, etc., for a native sorcerer to be able to cause all sorts of trouble to the man who made the foot-print. Dr. Strong further confirms the statement that the masks are kept jealously guarded‡ from women. Though of recent years there has been no difficulty in obtaining masks, the natives showed the most intense anxiety that the women should not be allowed to see them.

The Semest§ ceremonies occur occasionally and are essentially initiation ceremonies for the youths although they are different from the ordinary initiation ceremonies.

When the ceremonial paraphernalia is being prepared an enclosure is made a short way out of the village for the purpose.

\* Chalmers, *Pioneering in New Guinea* (1885-1887).

† With reference to "experts" who from the native point of view preside over the various departments of native life, consult C. C. Seligman, "The Melanesians of British New Guinea," 1910, p. 299.

‡ Haddon, A.C., "Descriptive Art of B. New Guinea," pp. 105-107."

§ Chalmers and Gill, *Work and Adventure in N.G.*, 1885, p. 138.

I am indebted to Mr. E. R. Stanley, Govt. Geologist of Papua, for his kind permission to use the three photographs here reproduced and for the details which enable me to illustrate them.

Plate 1 illustrates varieties of the Semese (Sivesi) masks used in the Kaiva Kuku ceremonies at Koraita, near Kerema, Gulf Division, and the large type of symmetrical work seen in this illustration has only been met with in the Vailala and Kerema villages. They vary in height from 6 to 25 feet or more\*; the longer varieties being held in the vertical position by means of light rope stays. There is a common method of ornamentation—the upper portion being more or less consistent, the lower variable. Sometimes the decoration consists of heptad figures or circles, usually five stringers top and bottom adjoining circles. The whole periphery of the broad portion of the mask is decorated either with cockatoo feathers or lorikeet coloured plumage; just within the periphery the mask is coloured with a serrated decoration common to all masks of the Semese. The large pole above the apex and the broad portion of the mask are coloured alternately in broad black, red and yellow bands, except that sometimes white is substituted for the yellow. At the bottom of the mask is a rami-like contrivance or pubic covering consisting of plaited and unplaited banana stem fibre.

Immediately above the rami and distributed laterally are two projections meant to resemble ears, decorated consistently with serrations. On occasions these ears are made to resemble those of the ceremonial pig. On the same horizontal plane and at right angles to the ears is another projection resembling the mouth of the crocodile and rarely the pig. It consists of an upper and lower jaw studded with prepared spines from the sago or coconut timbers. The mouth is always gaping and the eyes of the native dancing with the mask are situated about this point so that he can see where he is going.

The masks are prepared in a secluded spot out of sight of young boys and women folk. It is generally understood

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\* T. F. Bevan, *Toil, Travel and Discovery* in B.N.G., 1890, p. 145.

that if women were to look upon any of the Semese they are expected to die. The frame work consists entirely of lolia-cane bent and shaped approximating the finished articles. A fabric prepared from the ilimo (paper grass trees) is then dried and stretched across the entire surface and the two sides of the frame. Small dry, stringy-like pieces of creeper are then sewn into the fabric imitating the design described above and shown in the picture. When this is completed the peripheral feathers are added and a chief and colour-man finish the mask off with various colours.

The Semese ceremony lasts from about 14 to 20 days during which period the visitors and performers partake of much food in the form of pig, taro, sago, sweet potatoes, betel-nut, etc. The persons carrying the masks trot about the village for periods of an hour or so and then rest for half an hour. The final performance of the Semese is when all the performers trot about very rapidly round every house or any object which during the last year or so has been responsible for the death of one of their own members, or anything that the native mind considers to be unclean or evil; by this means they collect all the evil spirits and dump the masks in a heap and burn them up and, metaphorically, the evil spirits with them. After a period of eighteen months or two years they commence to re-build the masks for the same purpose.

At certain intervals in the Semese ceremonies the women take part and only at this period are they allowed to look upon the large masks. The women wear masks of entirely a different nature, being only two or three feet high and consisting largely of feathers from the cockatoo and Bird of Paradise. These masks are mitre-shaped with an internal decoration similar to the large masks. This ceremony is illustrated in plate 2. The movements are also different, the women, who wear large rami, dance gracefully in a circle swinging the rami with each movement. This part of the ceremony lasts about five hours and takes place every other day during the Semese ceremony.

Plate 3 gives us a closer view of the Semese masks and their mouth-pieces.

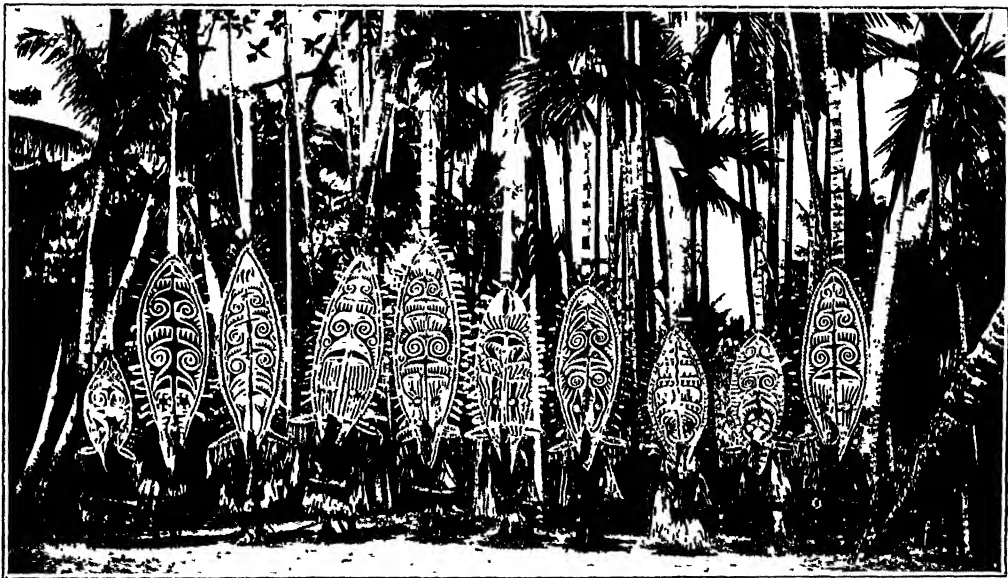
The Kaiva Kuku ceremony involves the above but the Kaiva Kuku masks are much smaller and imitate birds, pigs, crocodiles, fish, etc., and even human beings.

Although this information has been gleaned from most reliable sources, the original Kaiva Kuku ceremonies are nevertheless rapt in mystery. Until quite recently it would have been impossible, except at very great risk, to even obtain a photograph of the masks, much less the dances themselves. The ceremonies were always held most secretly, and nothing of what transpired was allowed to leak out; that fearful ordeals were enacted and the cruellest of practices indulged in seems to be certain, but whether the sufferers were always the victims of tabu or revenge does not transpire. From what I gathered in conversation with Mr. G. S. MacDonell (late of Orokolo) I should almost be inclined to give to the Kaiva Kuku "inner" ceremonies a phallic significance of indirect importance; it seems to me as if certain definite ceremonials had been practised as a matter of course, and from what we know of the Melanesians generally such interpretation is not to be excluded without further investigation. Only with very much persuasion can the Papuans of this district be induced to throw any light upon this subject, the secrets of which they still guard with characteristic cuteness.\*

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\* Rev. T. Holmes. Initiation ceremonies of the Natives of the Papuan Gulf. *Jour. Anth. Inst.*, Vol. 32, 1902.

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SEMESE DANCE. Koraita Village, Kerema, Gulf Division of Papua.





A Stage in the SEMESE CEREMONY—in which women take part and wear only small masks.  
Koraita Village, Kerema, Gulf Division.





A Closer View of SEMESE MASKS showing the mouth parts. Koraita Village, Kerema, Gulf Division.



(Communicated by T. H. Johnston, M.A., D.Sc.)

SOME PRELIMINARY NOTES ON THE HABITS  
OF THE DAWSON RIVER BARRAMUNDI.  
*SCLEROPAGES LEICHHARDTII.*

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BY T. L. BANCROFT, M.B. (Edin.)

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(Read before the Royal Society of Queensland, 29th May, 1916).

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I have long been anxious to ascertain the method of spawning of the Barramundi. Nearly three years ago Mr. Harry Pearce captured some Barramundi in a net of six-inch mesh, on the Dee River, a tributary of the Dawson. These, when examined in August, 1914, were found to contain very advanced roe; there were about fifty eggs in the mass, the diameter of the ovum being about 8 mm. September and October being the spawning season of the fishes of the Burnett, and the ova of the Barramundi having been noted in an advanced stage in August, lent support to the likelihood of September being the most suitable time to make an investigation of the kind. I therefore spent a brief holiday on the Dawson River in the latter part of September, 1915.

We proceeded first to Mostowrie, on the Dawson, the property of Mr. F. M. Bell, but the river at this point is too deep and too wide (over a hundred yards) for the purpose, though large Barramundi were seen swimming about on the surface; with a boat this might be a good spot to study the fish.

Whilst at Mostowrie, Mr. A. J. Cook informed me that, twenty years ago, Mr. Homer, of Barfield Station, whilst dragging a net in the river had pointed out to him, tiny fish swimming into the mouths of large Barramundi. This is interesting and important, for it points to the probability of the Barramundi carrying its developing ova in the mouth.

We next proceeded to Gyranda, ten miles further on, belonging to Mr. H. D. Tidswell. Here there is a narrow strip of water, ten to fifteen yards wide and about half-a-mile long, connecting two large lagoons extending for miles. The width of the river in these lagoons varies from 40 to 60 yards. We set our net in a suitable place, and left it all night. On dragging it out we were astonished at the number and size of the salmon-catfish. There were 32 of these, from 2 to 10lbs. in weight, besides bony-bream, silver-perch, jewfish, eels and tortoises, but only two Barramundi. We tried again several times, but always with similar results—numerous catfish and tortoises, but few Barramundi. We tried dynamiting alongside timber at the water's edge, but secured only gobies and bony-bream by this means.

The mouths of the Barramundi, whether netted or caught with a hook were found empty of spawn as might have been expected.

We noticed that although the stomach of the Barramundi is comparatively small and mostly contained insects, yet the fish ate bony-bream. For some time after a dynamite charge had been fired, Barramundi would frequent the spot and feed upon the small bream that had been killed or wounded, and we netted two fish at a spot where a plug had been fired, whose stomachs contained parts of bony-bream. We also observed that the latter species was the best bait for taking the fish on a hook.

The smallest Barramundi caught was twelve inches in length. Mr. Tidswell has observed very small ones on the surface at a narrow, shallow spot on the river at Gyranda on very hot days in summer time, and believes that they might be taken with a small hook. He also stated that the Barramundi bite better in the hotter weather.. Upon our arrival at Gyranda the weather was warm, and we caught several on a line, but a cold snap came, after which we did not succeed in catching any more. Owing to the bony nature of the mouth and tongue, it is an unsatisfactory fish to catch on a line, the hook rarely penetrating past the barb. If the fish is given the slightest slack, he will turn over and detach the hook; the only

way is to pull in as fast as possible. I had already observed the same difficulty on the Gregory River when fishing for the Northern Barramundi, *Scleropages jardinii*, having noticed the fish open its mouth and reject the bait. On the Gregory, I succeeded in catching a few with night lines, the fish being invariably hooked in the stomach.

There are no water weeds rooting at the bottom in the Dawson River, though in places there is *Azolla* on the surface. The river is deep from the bank, rarely being less than six feet in depth even in a dry time.

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# THE ENDOPARASITES OF THE DINGO, *CANIS DINGO*, BLUMB.

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BY T. HARVEY JOHNSTON, M.A., D.Sc.

Walter and Eliza Hall Fellow in Economic Biology,  
University, Brisbane.

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(Read before the Royal Society of Queensland, 31st July, 1916).

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For many years I have endeavoured to obtain from various districts in New South Wales and Queensland endoparasitic material from the warrigal or dingo, my main object being to ascertain whether the adult hydatid tapeworm occurs in this host. The question as to whether the dingo is indigenous to Australia or has been introduced by man, or has gained entrance by means of former land connections prior to the advent of man in our continent, is of considerable interest, but need not be dwelt upon here. Mr. R. Etheridge, Curator of the Australian Museum, Sydney, has recently published a review of the matter (1916). It is worthy of note that the animal does not occur, and apparently has not occurred, in Tasmania, and that remains of a species of *Canis* have been found in post-pliocene deposits at least in New South Wales. One cannot help believing that our wild dog is not a member of our indigenous fauna, but is an invader from the adjacent lands lying to the north.

One difficulty has been to obtain material from pure dingoes since many of the animals are hybrids between *C. dingo* and the domestic dog. Some little time ago Dr. T. L. Bancroft forwarded me some parasites from a dingo shot near Eidsvold, Burnett River.

There are already two species of entozoa recorded from this host, viz., the hydatid and a pentastome, *Linguatula dingophila*, Johnson.

*The Hydatid.*

*Echinococcus granulosus*, B., more commonly known as *Tænia echinococcus*, Sieb., was stated by Lendenfeld\* (1886) to infest it. This author referred to the common occurrence of the cystic or hydatid stage in human beings in the dry inland districts of Australia where dingoes were plentiful and the water supply scanty, both man and beast depending on water holes whose contents were frequently contaminated. He regarded the dingo as the agent responsible for infecting such water supply, and thus the chief transmitter as far as man was concerned. He examined many dingoes, and in 80 per cent. of those searched, found from one to five cestodes which he regarded as *T. echinococcus* in spite of the fact that they were much longer than the latter, often reaching to 10 or even 30 mm. in length. He mentioned that the hydatid tapeworm† occurred commonly in the domestic dog in the mountainous region of Eastern Australia. Lendenfeld has certainly confused two or more species, as *Echinococcus granulosus* is a very small cestode, the longest that I have from the domestic dog (from New South Wales and South Australia), reaching only 2.5 mm., the average being about 2 mm. Dr. Angus Johnson did not find the species in the one dingo examined by him, nor was I successful when searching the Eidsvold material.

The chief transmitting agent of the hydatid is undoubtedly the domestic dog, but I think that dingoes also harbour the cestode and contribute to its dissemination, amongst Australian cattle, sheep, marsupials, etc.

As regards the species which Lendenfeld actually found, I would suggest that it was either a new species,

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\*I am indebted to Dr. S. J. Johnston and Miss Marie Erhard, of Sydney University, for forwarding a copy of this paper to me from Sydney, as it was not available in Brisbane.

†The prevalence of hydatids in man and the dog in Australia, especially in the south-eastern corner, had previously been emphasised by Dr. D. Thomas, P.R.S., Lond., 38, 1885, p. 444-57; *Ibid.*, p. 457-8 (in 40 per cent. of the dogs examined by him, and in 50 per cent. of those examined from Melbourne); "Hydatid Disease with special reference to its prevalence in Australia," Adelaide, 1884; Trans. Roy. Soc., S. Austr., 4, 1880-1; *Ibid.*, 6, 1883; etc.

or more probably, that it was one of the several cestodes known to parasitise the domestic dog in Eastern Australia. The most likely species would be *Dipylidium caninum*, or perhaps *Tænia pisiformis* (*T. serrata*). One probably should not take too literally his statement as to the agreement of the dingo tapeworm with the hydatid. Again, the latter helminth, when present in a canine, generally occurs in considerable numbers owing to its mode of development from the cystic stage.

*Linguatula dingophila*, Johnson.

This parasite, a female, was found and described by Dr. A. Johnson (1910) in the nasal cavity of a pure-bred dingo in South Australia. A figure showing the external characters was given by him, but no information was supplied regarding the anatomy. A comparison of this helminth and *L. rhinaria* (= *L. serrata*) was given in a tabulated form (p. 249), but the only differences of any importance in my opinion are those relating to the sizes of the adults and of the eggs, and the form of the posterior end of the animals. The length of *L. serrata* is given as 8 to 13 cm.; *L. dingophila*, 3.1 cm., i.e., only about one-third as long. The egg of the latter is stated to be .05 mm. by .025 mm., whilst that of the former is .09 by .07 mm. I suspect that the former egg measurements are incorrect.

The posterior region of a fully adult female, *L. serrata*, is much more elongate than in *L. dingophila*, but I believe the latter name to be based merely on a specimen of *L. serrata*, which had not attained full size. Dr. Cleland and I (1910) found that the larval stage of the latter (often called *Pentastomum denticulatum* in this condition) occurs not uncommonly in the mesenteric glands of cattle in Sydney slaughter-yards and in the Illawarra district (N.S.W.). Dr. Ralph (1865) found it in Victoria as long ago as 1865. The parasite almost certainly occurs in Queensland too, but has not been definitely recorded as yet. These facts are evidence of the presence of the adult in the nasal region of dogs in N.S.W. and Victoria at least. I infected the nose of a Sydney dog with some of the larvæ, and later on a few adult female pentastomes were obtained from it (Johnston, 1911, a, b).

I consider that *L. dingophila* should be ranked as a synonym of *L. serrata* until some anatomical differences be noted. The latter is known to infest in its adult condition, not only the dog, but also the wolf and fox, and occasionally the domesticated animals and man.

*Dipylidium caninum*, L.

Dr. Bancroft's material contained a number of specimens—some being only 20 mm. in length—of this cestode which commonly infests cats and dogs in Australia. It is now recorded for the first time as a parasite of the dingo.

*Ancylostoma caninum*, Erc.

A few specimens, both male and female, of this species of hookworm were found amongst the Eidsvold material.

*A. caninum* has already been recorded by me as occurring in dogs and occasionally in cats in Queensland, and in the former host in several other States of Australia.

*Other Parasites.*

As Australian sheep harbour the cystic stage, not only of the hydatid cestode, but also of *Tænia hydatigena* (*T. marginata*, *Cysticercus tenuicollis*), a parasite sometimes met with in local dogs, it is not unlikely that the dingo may be parasitised by both of these species in sheep country.

In south-eastern Australia rabbits are often infested with the bladderworm stage of *Tænia pisiformis* (syn. *T. serrata*; *Cysticercus pisiformis*) and *Multiceps serialis* (syn. *Tænia serialis*; *Cænurus serialis*), both of these helminths reaching maturity in dogs. No doubt the dingo becomes infected in Victoria and New South Wales, and perhaps elsewhere, in rabbit-infested districts.

Amongst the nematodes known to parasitise dogs, two are not uncommon in Australia, viz., *Dirofilaria immitis*, Leidy and *Toxocara* (*Toxascaris*) *canis*. The former infests the right heart and has been recorded from the coastal regions of Queensland and from Western Australia, while the latter has been reported from most of the States. It is not unlikely that both may be found in the dingo.

There are then three known parasites of *Canis dingo*, viz., *Dipylidium caninum*, *Ancylostoma caninum* and *Linguatula serrata*, all of which are known in Australia as entozoa of the domestic dog. The hydatid most probably occurs, and the presence of several other cestodes and nematodes is not unlikely\*.

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\*Gilruth, Sweet and Dodd (Parasitology 4, 1911, p. 1) have referred to the presence of bodies resembling *Anaplasma marginale*, Theiler, in the blood of a young dingo, three months old, in the Melbourne Zoological Gardens.

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## *FENESTELLA* AND *POLYPORA* (?) IN SOUTH-EASTERN QUEENSLAND.

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BY A. B. WALKOM, B.Sc.

Assistant Lecturer in Geology, the University of Queensland.

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(Read before the Royal Society of Queensland, 25th September,  
1916).

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The present note is written for the purpose of recording the occurrence of *Fenestella* and *Polypora* (?) in a boulder about eight inches in diameter in a conglomerate of Cainozoic age near Richmond Gap (Grady's Gap); and also of calling attention to some of the questions suggested by its occurrence. The boulder consists of an olive-green, somewhat indurated shale, and contains at least two species of bryozoan, and in addition a few fragments of a crinoid stem. One of the bryozoans is certainly identical with *Polypora* (?) *smithii*, Fth. fil., as figured in "Geology and Palæontology of Queensland," plate 9, figs. 1-3, but not with plate 44, figs. 9-10 (it is indeed difficult to reconcile figures 9 and 10 on plate 44 with the description on page 219 and figures 1-3 on plate 9); the other bryozoan is probably *Fenestella fossula*, Lonsd.

The beds in which the boulder occurs, consist of sandstone and conglomerate which undoubtedly appear to be interbedded with one another; Dr. Richards has calculated their thickness at a minimum of 20 feet, and their height above sea level as about 1,000 ft. They dip in a general south-westerly direction at a small angle (about 5°) and outcrop on the road at Lahey's Cutting in portion 58v, Parish of Telemon.

In 1911\* Mr. R. A. Wearne recorded the discovery of a specimen of *Fenestella fossula* immediately north-west of Mt. Barney and about 16 or 17 miles west of Richmond Gap; from this specimen he concluded that rocks of Permo-Carboniferous age existed in that district where they were formerly considered Trias-Jura. He refers to the same specimen elsewhere† and comments on the fact that the rocks are quite undisturbed. In this connection it might be pointed out here that the nearest rocks of undoubted Permo-Carboniferous age both in Queensland (Warwick District), and New South Wales (north of Drake and Rivertree) have all suffered a considerable amount of metamorphism.

Mr. Wearne has informed me that he collected the specimen when time did not permit him to make any further investigations as to its source, and he agrees with me that it was probably another such occurrence as the one now recorded.

The nearest outcrop of Permo-Carboniferous rocks to Richmond Gap is about 25 miles away in a south-westerly direction‡. They are excessively folded and faulted and contain indurated clays and shales. These extend southwards past Drake and have been described by Andrew §. At various points in them fossils have been found and these include *Fenestella fossula* and *F. internata*. These rocks extend to the east under the Clarence series, but it is not known how far.

Permo-Carboniferous rocks also occur at Warwick, about 60 miles N. of W. from Richmond Gap, and they are extensively folded and faulted.

Fragments of plant fossils were found in the sandstone associated with the conglomerates, but they were too fragmentary for determination. Dr. Richards has visited the area again, and found further specimens which prove the sandstone to be of Cainozoic Age. The remains he found include dicotyledonous leaves and portions of a fern

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\*Proc. Roy. Soc., N.S.W., xlv., 1911, p. 142.

†A.A.A.S., xii. (Sydney, 1911), p. 125.

‡See Geological map of N.S.W., 1914.

§Geol. Surv., N.S.W., Mineral Resources No. 12, 1908.

probably identical with *Pteris abbreviata* Deane described from Elsmore, New England District, N.S.W.\* Dr. Richards† has placed the conglomerate and sandstone between the middle and upper divisions of the volcanic rocks to which he assigns‡ a (?) middle and (?) upper Cainozoic age respectively.

The source of the boulder containing *Fenestella* and *Polypora* (?), seems almost certainly to be in the Drake District, and we have, therefore, further indication of a south to north drainage in Cainozoic times.

Dr. Richards§ has already shown that the general direction of the drainage when the volcanic rocks were poured out was north and south. Wearne and Woolnough|| on the other hand, suggest that in Cainozoic times the Water Divide was far to the east of its present position, and that there were at least four important streams flowing in a westerly direction.

These two views appear to be in conflict, and of the two, the north and south drainage is based on the more definite evidence. Whether the two can be shown to be in harmony is a question for future study. ■

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\*H. Deane Rec. Geol. Surv., N.S.W., vii. (1900-04), p. 231, pl. XLV.

†Proc. Roy. Soc. Qld., xxvii (1915), 1916, p. 115.

‡Op. cit., p. 125.

§Proc. Roy. Soc., Qld., xxvii., 1916, p. 110.

||Op. cit, p. 139.

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## QUEENSLAND ETHNOLOGICAL NOTES.

BY RONALD HAMLYN-HARRIS, D.Sc., F.R.A.I.

(Read before the Royal Society of Queensland, 25th September, 1916).

### PLATE IV.

#### (a) A SO-CALLED "MORAH" SLAB FROM NORTH QUEENSLAND.

In the Cairns District of Queensland, a special mealing stone is met with, the set consisting of (a) a nether stone, a piece of slate transversely fluted on one side only known locally by the name of "Morah"; (b) a spheroidal upper stone. The former represents the fixed slab and is oblong-ovate—the contours being irregularly defined, one end being less obtuse than the other. The transverse grooves, 36 in number, being continuous over the rounded edges to the circumference (Plate IV., fig. 1).

With the crusher or upper stone the natives grind and work the beans or nuts into a paste, the moisture of which—often poisonous in character—drains off by means of the grooves. When the paste is fine enough the product is dried in the sun or by the fire, and rubbed into a flour and put away for future use.

As this process entails some amount of care and pains, it is naturally to be supposed that only those who are not too lazy would go to the trouble, and in reality this is so.

Measurements are as follows:—

Length of slab,  $13\frac{1}{4}$ ".

Greatest width of slab,  $6\frac{7}{8}$ ".

Thickness of slate,  $1\frac{1}{2}$  in."

The top stone is evidently a naturally-formed river pebble picked up in the first instance on account of its suitability, and measures  $5\frac{1}{2}$ " x 4".

Through the kindness of Mr. R. Etheridge, the Curator of the Australian Museum, Sydney, I am permitted to make use of the following information :—

“ In our collections are three specimens of the grooved or fluted type, as follows :—

1. Cast of Slate Slab, oval, 12" x 8", transversely fluted, the latter sharply cut on both sides. Whether these grooves are for the better distribution of the grain or to run off juices is not known. The original was found in the scrub, near Atherton, Queensland.

2. Cast of the upper portion of Fluted Sandstone Block, oval, 7" x 5", flutings longitudinal, more or less undulating. The original is from the bed of Moona Creek, Georgina River, Queensland.

3. Deltoid fragment of a large Slate Millstone, fluted on both sides similar to specimen No. 1. This third specimen was called “ Morah ” when collected by Mr. Hedley in the Cairns District in 1901. Accompanying it was a river pebble Rubber or Top-stone, used in conjunction for “ grinding nuts into flour.”

The geographical distribution is evidently very limited. The home of the fluted type of grinding stone made of slate is in the Cairns District, and the presence of a similar, though distinct, specimen of sandstone in the bed of the Moona Creek rather suggests the possibility of transportation, along certain recognised routes such as the Georgina River for purposes of barter.

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#### (b) AN ABORIGINAL KNIFE FROM QUEENSLAND.

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A knife somewhat unique in its manufacture has recently come into the possession of the Queensland Museum through the kindness of Mr. T. Illidge, who acquired it some thirty years ago at a native camp at St. Lawrence. This implement, consisting of a single-flaked knife and a proteting part, differs from the usual kind of hafted knives, and is an illustration of an example of individual idiosyncrasy in handicraft.

It was known by the native name of "Decrannie," and the keen edge of the lancet made the latter particularly suitable for scarifications (tribal marks, etc.)

The specially-flaked piece of bottle glass is not too securely attached to a flat piece of wood by means of gum (not gum cement). The blade when not in use is protected by being inserted into a groove at the upper end of a piece of rounded hardwood as seen in the illustration. (Pl. IV., fig. 3). The two pieces are then tied together with some grass or vegetable fibre to keep them intact, and when thus placed the scarifying portion of the implement is in an unsymmetrical position, due to inaccuracy in the making.

Measurements are as follows :—

Length of knife, 73mm.

Length of blade of knife, 25mm.

Width of handle of knife, 11mm.

Length of protecting case, 120 mm.

Width of protecting case, 15mm.

and the greatest width of the groove is 5mm, narrowing down towards the centre of the wood to suit the shape and angle of the blade.

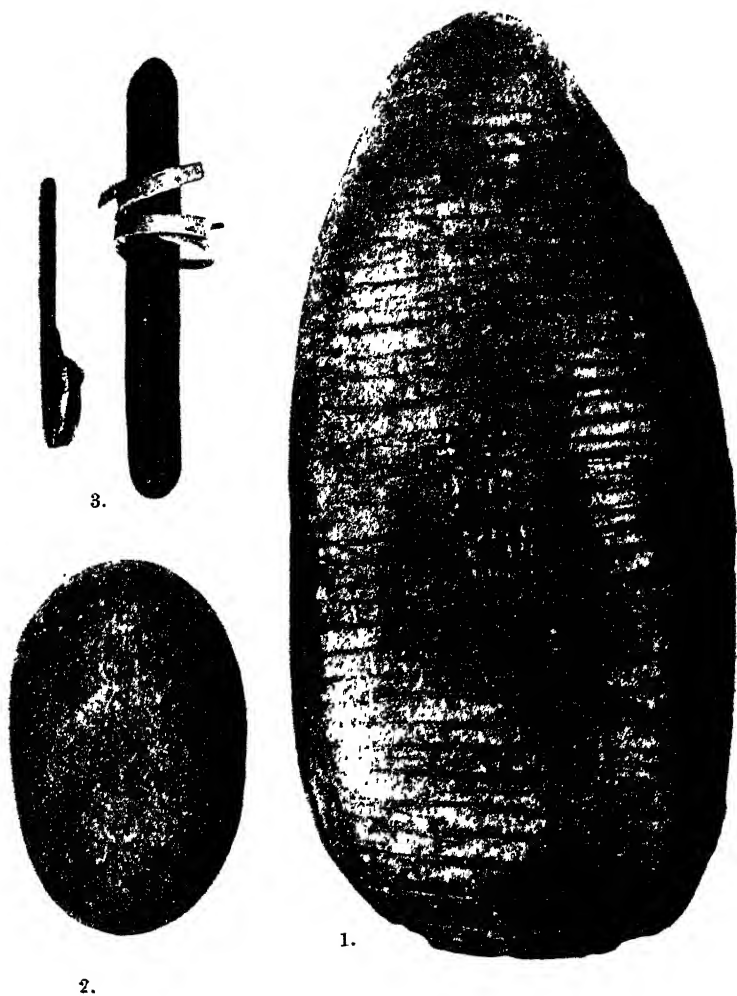
Lord Avebury, in "*Prehistoric Times*" (1900), (p. 422 refers to and figures (fig. 220) a knife similarly mounted but consisting of splinters of quartz (or flint) arranged in a row after the manner of the Queensland "Shark-Tooth Knife," but possessing no protective portion as in specimen above described. This instance is also interesting evidence that there was no persistency of type amongst Australian hafted cutting implements.

#### EXPLANATION OF PLATE IV.

FIGS. 1 AND 2.—A "Morah" Slab, with its grinder from Cairns, North Queensland.

FIG. 3.—An Aboriginal Knife and Protecting Sheath from St. Lawrence, Queensland.

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# NOTES ON A FEW INTERESTING PLANTS COLLECTED IN THE VICINITY OF BRISBANE.

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By C. T. WHITE  
(Botanic Gardens, Brisbane).

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(Read before the Royal Society of Queensland, 30th October,  
1916).

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The following observations relate to a few plants collected during the past couple of years in the neighbourhood of Brisbane; unless otherwise stated the specimens have been gathered personally by myself and many of them on the local excursions of the Field Naturalists' Club. Several references are made to specimens in the Queensland Herbarium, and my thanks are due to the Government Botanist (Mr. J. F. Bailey) for permission to use this material.

## MENISPERMACEÆ.

LEGNEPHORA MOOREI, *Miers*.

This is a very common climber in the Brisbane scrubs, the leaves are often very large, some in our collection being 10in. diam. on petioles of 7in.; these leaves are found scattered about the floor of the scrub in great abundance.

## MALVACEÆ.

SIDA CORDIFOLIA, *Linn.*

Has been met with in several places about Brisbane. It is a very common weed about some of our northern towns. In the Queensland Herbarium we have it from the following localities:—Johnstone River (N. Michael); Stannary Hills (Dr. A. L. Bancroft); Lucinda Point (G. B. Forrest); Cairns (E. Jarvis); Rockhampton (C.T.W.); Townsville (various collectors).

## CELASTRINEÆ.

CELASTRUS BILOCULARIS, *F.v.M.*

The form with sharply-toothed leaves is to be found about Brisbane, usually on the edge of scrubs and in the thicker forest country.

## LEGUMINOSÆ.

DAVIESIA UMBELLULATA, *Sm.* Sunnybank (C.T.W.), Stradbroke Is. (various collectors).

DAVIESIA CONCIENNA, *R.Br.* Chermside.

These specimens are typical and, by the broadly ovate leaves, can be distinguished from *D. umbellulata* which it approaches very closely, and of which in my opinion it should only rank as a variety.

CROTALARIA JUNCEA, *Linn.* Brisbane River.

CROTALARIA QUINQUEFOLIA, *Linn.* Kedron Brook (J. Keys).

In the "Flora Australiensis" and "Queensland Flora" this species is recorded only from the Endeavour River. It has recently been gathered at Buderim Mt.; there is also an old specimen in the Queensland Herbarium labelled "waste places about Brisbane, F.M.B."

## COMPOSITÆ.

COTULA CORONOPIFOLIA, *Linn.*

This succulent Composite, recorded for Queensland by F. M. Bailey in 1910 without specific locality, has recently been met with in great abundance in several places along the Brisbane River:—Norman Ck. (C.T.W.); Breakfast Ck. (H. A. Longman); near Botanic Gardens (W. Sauer). It has also been met with at Currumbin Creek.

EMILIA SONCHIFOLIA, *DC.*

This tropical weed has been noticed growing in abundance in several localities in Southern Queensland; it seems generally to grow in the vicinity of railway lines, between the sleepers, etc., so in all probability has been introduced from the North.

SENECIO AMYGDALIFOLIUS, *F.v.M.* Gold Creek, near Brisbane.

This large growing *Senecio* is fairly common in Southern Queensland; besides the habitats recorded in the "Queensland Flora," we have it in the Queensland Herbarium from the following localities:—Wellington Pt. (J. Wedd); Macpherson Range (C.T.W.); Killarney (J. F. Bailey); Mt. Samson (C.T.W.); Mt. Perry (J. Keys).

### MYRSINEÆ.

MYRSINE CAMPANULATA, *F.v.M.*

Very common on hills in the forest country about Brisbane (Taylor's Range, Enoggera Range, Gold Creek, etc.)

F. v. Mueller, in *Fragm.*, VI., 235, and F. M. Bailey in "Queensland Flora," p. 949, both describe the margins of the leaves as entire. It is a common shrub in Southern Queensland, but in all our specimens a leaf with entire margin is rare, most of them being distinctly dentate in the upper half as shown in the "Comprehensive Catalogue of Queensland Plants," p. 302, fig. 275. Nimmul Mt. (C.T.W.), and Nambour (Dr. F. H. Kenny) are extensions of our knowledge of the plant's range.

### POLYGONACEÆ.

POLYGONUM PROSTRATUM, *R. Br.* Brisbane (E. W. Bick).

These specimens are glabrescent, almost glabrous. We have specimens in our collections from the following localities:—Tarampa (F. M. Bailey), Roma, Hendon and Taabinga (C.T.W.); these are all strongly strigose. All our specimens show the stipules bearing a short, foliaceous, lobed lamina at the mouth.

### ALISMACEÆ.

DAMASONIUM AUSTRALE, *Salisb.*, Brisbane River.

We have numerous specimens in the Queensland Herbarium from various localities in Southern Queensland.

## NAIADEÆ.

TRIGLOCHIN PROCERA, *R. Br.* var., DUBIA (*R. Br.*), *Benth.*

Swamps at Sandgate (Moreton Bay). The large curved carpels free from the base distinguish this variety from the normal form. The plants are of a more robust, upright growth, the leaves are stiffer and more ascending than in typical *T. procera*. *Triglochin procera*, *R. Br.*, is a very common plant in the pools about Brisbane and is extremely variable.

## GRAMINEÆ.

PANICUM OBSEPTUM, *Trin.* Wellington Point and Enoggera.

In these two localities this grass is found covering fairly large areas of wet, swampy land, and is undoubtedly one of our best sorts for such places.

CHAMÆRAPHIS PARADOXA, *Poir.* In swamps, Wellington Point.

This grass is admitted into the "Queensland Flora," as 'Recorded for Queensland by F.v.M.,' so this record of a specific locality is interesting.

CHRYSOPOGON ELONGATUS, *Benth.*, var. FILIPES, *Benth.*

This grass is common on hill-sides in forest country about Brisbane.

ARISTIDA CALYCINA, *R. Br.* Brisbane River (E. W. Bick).

CHLORIS UNISPICEA, *F.v.M.*

F. M. Bailey, in "Comprehensive Catalogue of Queensland Plants," p. 627, refers to the inflorescence in some specimens from Tarampa bearing 1-3 spikes; the species is fairly common in some places along the Brisbane River and shows the same variation; it has also been collected at Mt. Larcom by E. W. Bick, and these again more frequently have 2-3 than 1 spike to the inflorescence.

ELEUSINE INDICA, *Gaertn.*, var. MONOSTACHYA, *Bail.*, *Ql. Flora*, p. 1898.

*E. indica* is one of the commonest grasses in Queensland; it is very abundant about Brisbane and exhibits great variation in the number of spikes in the inflorescence,

and specimens with only one spike have frequently been gathered about Brisbane, this reduction occurs especially amongst starved and depauperate plants; as, however, specimens have several times been gathered showing a variation of 1-2-3 spikes in the same plant, it seems hardly advisable to keep this variety.

#### FILICES.

*ADIANTUM HISPIDULUM*, Sw., var. *HYPOGLAUCUM*, Domin.

Gold Creek and Pine Mt., in the neighbourhood of Brisbane.

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# THREE UNDESCRIBED QUEENSLAND FISHES.

BY J. DOUGLAS OGILBY.

(Communicated by Mr. H. A. Longman.)

(Read before the Royal Society of Queensland, 27th November, 1916).

PARAPLESIOPS JOLLIFFEI, *sp. nov.*

(Bluetip Longfin).

Body subovate, its depth subequal to the length of the head, which is 2.67 in that of the body. Snout linear, three fourths of the eye-diameter, which is 3.25 in the head; interorbital width 2.67 in the eye-diameter. Maxillary extending to below middle of eye. Scale formula  $2/32/14$ ; lateral lines  $28/12$ . Dorsal  $xii10$ , originating above opercle; last spine longest, 1.9 in length of head and 2.15 in the 7th and longest ray, which is 2.4 in the body-length. Caudal rounded; middle rays as long as dorsal lobe. Anal  $iii11$ , originating below the 11th dorsal spine, the last spine and the seventh ray a little longer than those of the dorsal. Pectoral with 18 rays, rather longer than the head. Ventral one seventh longer than pectoral, extending to the 8th anal ray, its spine four sevenths of head. Gill-rakers 11 (four tubular) on lower branch of anterior arch, the longest one fourth of the eye-diameter. Body purplish black, the last third of the trunk and the tail with six obscure grayish cross-bands, which do not reach the dorsal surface. A navy blue band from the nostril to the angle of the preopercle; cheeks and opercles sparsely blue-spotted. Pectorals greenish yellow; other fins purple tipped with sky-blue; caudal, and in a lesser degree soft dorsal and anal, with a network of grayish lines, forming a mosaic pattern. (Named after my friend, Mr. Edwin Alfred Jolliffe, an enthusiastic fisherman and keen observer, by whom it was captured).

Described from a single example, 151 millim. long, caught at Green Island, Moreton Bay. Reg. no., I. 16/2652.

From *Paraplesiops poweri*, Ogilby, the only other species as yet recorded from the Bay, this fish differs, not only by its wholly diverse colour-scheme, but by the extremely narrow interorbital region (8.75 in head), the additional anal ray, and the more produced ventral.

NEMIPTERUS THEODOREI, *sp. nov.*

(Butterfly Bream).

Body elliptical, its width about a half of its depth, which is subequal to the length of the head and 3.2 in that of the body. Snout convex, 2.4 in the length of the head; diameter of eye 1.55 in length of snout and subequal to the preorbital width; interorbital width convex, three fourths of the eye-diameter. Maxillary not extending to level of eye. Lower jaw without canines. Scale formula 3/48/9. Dorsal originating above opercular spine; spinous portion low, the spines feebly exerted, gradually increasing in length to the last, which is 2.4 in the head and 1.33 in the penultimate ray; soft dorsal and anal angulate. Caudal forked, upper lobe slightly the longer, 3.67 in the body-length. Anal originating below 2nd dorsal ray; 3rd spine longest, one third of the head and 1.45 in the last ray. Pectoral with 17 rays, 2.33 in the body-length. Ventral a little shorter than the pectoral, extending to the 2nd anal spine. Gill-rakers 7 on the lower branch of the anterior arch. Roseate above, shading imperceptibly through the iridescent pink of the sides to the pearly white of the lower surface; sides below the lateral line with five greenish-yellow horizontal bands, each of which occupies the middle of a series of scales, the upper and lower bands shorter and less conspicuous than the intervening bands; a shining red shoulder spot, covering the upper half of two consecutive scales, which vary from the 2nd and 3rd to the 4th and 5th below the lateral line. Upper surface of head with a tinge of lavender overlying the pink; a curved light blue bar from the front of the eye, passing along the upper edge of the preorbital and anteriorly changing gradually to a deep violet; a similar but less conspicuous band along the lower edge, continued as a violet band along its free border; upper lip yellow; cheeks and opercles pink with golden reflections; a distinct greenish blue spot, preceded by a purplish spot,

behind the upper angle of the preopercle. Lower two-thirds of iris vivid scarlet, upper third green, the colors sharply defined. Dorsal fin pink, bordered by a broad, gold-edged, lilac band; caudal pinkish yellow, broadly tipped with rose, the upper ray narrowly edged with gold, the lower with rose; proximal half of anal yellow, distal half lilaceous silvery, the former with a basal and two median pale blue bands; pectorals and ventrals colourless. (Named after the Hon. E. G. Theodore, M.L.A., in recognition of the formation by him of a Department of Fisheries.)

Described from a fine example, measuring 267 millim., taken by the writer on the Caloundra Banks, and now in the Queensland Museum, as also is a somewhat smaller example caught at the same time by Mr. T. C. Troedson; a third example is in the Museum of the Amateur Fishermen's Association. Reg. no. of type, I. 16/2648.

Five species of *Nemipterus* have now been recorded from the Queensland Coast, and may be recognized as follows:—

a<sup>1</sup>. Lower jaw with distinct canines.

b<sup>1</sup>. Scales in transverse series 4/14; spinous dorsal higher than the soft; colouration uniform .. .. *robustus*\*

b<sup>2</sup>. Scales in transverse series 4/11; spinous dorsal lower than the soft; body with yellow bands .. .. *taniopterus*

a<sup>2</sup>. Lower jaw without canines.

c<sup>1</sup>. Median dorsal spines longest.

d<sup>1</sup>. Scales in transverse series 3/12; upper caudal lobe not produced; colouration uniform† .. .. *upeneoides*

d<sup>2</sup>. Scales in transverse series 3/10; upper caudal lobe much produced; body with yellow bands .. .. *aurifilum*

c<sup>2</sup>. Posterior dorsal spines longest; scales in transverse series 3/9; caudal lobe not produced; body with yellow bands .. .. *theodorei*

CANTHERINES MAYNARDI, *sp. nov.*

(Brown-spotted Leatherjacket).

Body ovate, its depth at the ventral spine half of its length. Length of head 3.6 in body-length. Snout

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\*New name for *Synagris furcosus*, Gunther, not *Dentex furcosus*, Valenciennes.

†Bleeker (Atlas Ichth., pl. cccxxvii, fig. 2), figures this species with a large oval blackish shoulder-spot.

with an anterior protuberance, behind which it is feebly concave. Diameter of eye 3.8 in the length of the snout and equal to the convex interorbital width. Gill-opening exceptionally oblique, three-fourths longer than the eye-diameter, its upper and lower ends below the middle of the eye and the nostrils respectively. Scales represented by soft granules: caudal peduncle unarmed (? ♀); sides with a few short, thread-like cirri. Dorsal, spine above the last quarter of the eye, anteriorly with two approximate rows of blunt tubercles, posteriorly with two more remote rows of short blunt spines, its length 1.6 in that of the head; 2nd dorsal spine weak; soft dorsal feebly rounded with 35 rays, its height one third of length of head. Caudal rounded, a little longer than the head. Anal with 32 rays, one fourth shorter and a trifle higher than the soft dorsal. Pectoral inserted below the anterior half of the eye, a little longer than the gill-opening. Ventral spine small and rough, not projecting beyond the flap, which is moderately developed. Stone-gray, the head and body, except the throat and ventral flap, with numerous small round brown spots; outer edge of throat, in advance of the gill-opening, with a much larger blackish spot, which is connected with its fellow by a brown band; above the spot are two concentric semicircles of pale blue. Soft dorsal and anal gray, each ray with an inconspicuous darker intrabasal spot; caudal profusely brown-spotted. (Named after my friend, Mr. Lewis Holden Maynard, of Bundaberg, in recognition of his keen interest in the biology of our State).

Described from a fine specimen, measuring 317 millim., taken at Cowan Cowan, Moreton Bay, by Mr. James Palmer, and presented by him to the Queensland Museum. Reg. no. J. 16/2643.

The nearest ally of this species is *Cantherines macrurus*, Bleeker\*, from which, however, it differs in numerous minor characters, such as the increased number of dorsal and anal rays, etc.

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\**Monacanthus macrurus*, Bleeker, Nat. Tijds. Nederl. Ind., xii., 1856, p. 226; *Pseudomonacanthus macrurus*, Bleeker, Atlas Ichth., v., p. 134, pl. cccxxviii, fig. 2.

NOTE ON *AMIA NIGRIPES*, *Ogilby*.

Five years ago I described (Ann. Queensl. Mus., No. 10, 1911, p. 49) a new percelle under the name *Amia nigripes*, which has recently been beautifully figured by McCulloch (Biol. Res. Endeavour, iii, 1915, pl. xv, fig. 2). Having failed to notice that this name had been previously given to an East African species by Playfair (Fish Zannibar, 1866, p. 19, pl. v, fig. 1), I hereby propose to change the name of the Australian fish to *Amia atripes*.

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## **Abstract of Proceedings of the Royal Society of Queensland.**

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PROCEEDINGS OF ANNUAL MEETING, 27TH MARCH, 1916.

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Dr. T. Harvey Johnston, President, in the Chair.

His Excellency the Governor was present, attended by Captain Cozens, A.D.C.

The President announced that Volume XXVII, Part 2, of the Proceedings was published, and would be issued to members in a few days.

The Annual Report of the Council for 1915 was adopted on the motion of Dr. Shirley, seconded by Dr. Richards.

The Financial Statement was received on the motion of Mr. J. B. Henderson, seconded by Mr. H. A. Longman.

Mr. J. Bain was unanimously elected a member of the Society.

Messrs. Paul Sylow and W. D. Francis were proposed as members of the Society.

No other nominations for office bearers having been received, the president declared the following elected for the year 1916 :

Patron : His Excellency Sir Hamilton Goold-Adams, G.C.M.G., C.B., etc.

President : R. Hamlyn-Harris, D.Sc.

Vice-president : E. H. Gurney.

Hon. Treasurer : B. Dunstan, F.G.S.

Hon Secretary and Editor : A. B. Walkom, B.Sc.

Hon. Librarian : C. D. Gillies, B.Sc.

Members of Council : W. R. Colledge, T. H. Johnston, M.A., D.Sc., H. A. Longman, H. C. Richards, D.Sc., J. Shirley, D.Sc.

Hon. Auditor : Professor H. J. Priestley, M.A.

The new President was then installed, and he thanked members for his election to the office.

Dr. Hamlyn-Harris then asked the retiring President to deliver his address.

The address was divided into two parts, the first dealing with the activities of the Society during the past year, and to scientific matters in general in Queensland and Australia ; the second part of the address was of a scientific nature, the subject being " A census of the internal parasites recorded from Queensland." A number of lantern slides and many interesting specimens were exhibited in illustration of the subject, and special attention was paid to the parasites of man, and some of the domesticated animals in Queensland.

His Excellency the Governor thanked the Society for his re-election to the office of patron, and proposed a hearty vote of thanks to Dr. Johnston for his address.

Mr. J. F. Bailey seconded the vote of thanks, which was carried.

Dr. Johnston thanked the meeting for their appreciation.

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# THE ROYAL SOCIETY OF QUEENSLAND

### BALANCE SHEET for the Year 1915.

Er.

Dr.

| RECEIPTS                    |    |    |    | £     | s. | d. | £    | s. | d.  |
|-----------------------------|----|----|----|-------|----|----|------|----|-----|
| Balance from 1914           | .. | .. | .. | 49    | 12 | 10 |      |    |     |
| Subscriptions               | .. | .. | .. |       |    |    |      |    |     |
| For 1914 and previous years | .. | .. | .. | 24    | 3  | 6  |      |    |     |
| For 1915                    | .. | .. | .. | 69    | 7  | 0  |      |    |     |
| For 1916                    | .. | .. | .. | 1     | 1  | 0  |      |    |     |
|                             |    |    |    | <hr/> |    |    | 94   | 11 | 6   |
| Donations                   | .. | .. | .. |       |    |    | 1    | 2  | 6   |
| Sundry Small Receipts       | .. | .. | .. |       |    |    | 0    | 8  | 11½ |
|                             |    |    |    | <hr/> |    |    | £145 | 15 | 9½  |

| EXPENDITURE.                  |    |    |    | £     | s. | d. | £    | s. | d. |
|-------------------------------|----|----|----|-------|----|----|------|----|----|
| Printing (H. Pole & Co.)      | .. | .. | .. | 111   | 13 | 2  |      |    |    |
| Postage—                      |    |    |    |       |    |    |      |    |    |
| Monthly Notices               | .. | .. | .. | 2     | 3  | 4  |      |    |    |
| Librarian and Postage of Pro- |    |    |    |       |    |    |      |    |    |
| ceedings                      | .. | .. | .. | 4     | 5  | 0  |      |    |    |
| Biology Section               | .. | .. | .. | 0     | 10 | 0  |      |    |    |
| General                       | .. | .. | .. | 3     | 18 | 4  |      |    |    |
|                               |    |    |    | <hr/> |    |    | 10   | 16 | 8  |
| Insurance                     | .. | .. | .. |       |    |    | 1    | 2  | 6  |
| General Petty Cash, etc.      | .. | .. | .. |       |    |    | 2    | 6  | 1  |
| Attendance and Refreshments   | .. | .. | .. |       |    |    | 2    | 4  | 0½ |
| Card Index for Library        | .. | .. | .. |       |    |    | 2    | 12 | 0  |
| Hire of Furniture             | .. | .. | .. |       |    |    | 1    | 2  | 6  |
| Hire of Car                   | .. | .. | .. |       |    |    | 1    | 2  | 6  |
| Bank Charge                   | .. | .. | .. |       |    |    | 0    | 10 | 0  |
| Balance—                      |    |    |    |       |    |    |      |    |    |
| In Bank                       | .. | .. | .. | 12    | 5  | 3  |      |    |    |
| In Hand                       | .. | .. | .. | 0     | 1  | 1  |      |    |    |
|                               |    |    |    | <hr/> |    |    | 12   | 6  | 4  |
|                               |    |    |    | <hr/> |    |    | £145 | 15 | 9½ |

## ABSTRACT OF PROCEEDINGS.

ix

Examined and found Correct.

GEORGE J. MACKAY, FOR GEO. WATKINS, *Hon. Auditor.*

**29/2/16.**

E. H. GURNEY,

*Hon. Treasurer.*

ABSTRACT OF PROCEEDINGS, 1ST MAY, 1916.

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The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. Hamlyn-Harris, President, in the chair.

The minutes of the previous ordinary monthly meeting were read, and confirmed.

Miss Buckland Taylor, and Messrs. A. H. Chisholm and A. Valentine Soul, were proposed as members.

Messrs. W. D. Francis and Paul Sylow, were elected as members of the Society.

*The following papers were read:—*

1. The supposed Artiodactyle Queensland Fossils, by H. A. Longman.

Remarks were made by Dr. Johnston and Mr. A. B. Walkom.

2. The origin of manganiferous and ferruginous incrustations in rocks and streams, by W. D. Francis.

The paper was discussed by Drs. Johnston and Richards, and Messrs. Longman, Saint-Smith, Walkom and White.

3. The origin of iron and manganese ore in bogs and streams, by W. D. Francis.

Remarks were made by Drs. Johnston and Richards

Mr. H. A. Longman exhibited a live specimen of *Nephrurus asper*, Gthr., the "Ball-tailed Gecko," from Central Queensland, which had been donated to the Queensland Museum. This lizard has a big head, large eyes, a rough skin which brings to mind the test of a sea-urchin, long angular legs and a tail which ends in a ball, and is one of the quaintest reptiles found in Australia. It has a curious habit of raising itself to the full height of its thin legs, and then lowering its body to near the ground, this being done repeatedly. When disturbed it often gives a short side spring, and emits a cough-like bark which has gained for it the name of "Barking Lizard." In captivity it will feed on small grasshoppers.

## ABSTRACT OF PROCEEDINGS, 29TH MAY, 1916.

The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. Hamlyn-Harris, President, in the chair.

The minutes of the previous meeting were read and confirmed.

Miss Buckland Taylor, and Messrs. A. Valentine Soul, and A. H. Chisholm were elected ordinary members of the Society.

*The following paper was read:—*

Some preliminary notes on the habits of the Dawson River Barramundi, *Scleropages leichhardtii*, by Dr. T. L. Bancroft (communicated by Dr. T. Harvey Johnston.)

The President and Mr. Longman offered remarks on the paper.

The President (Dr. Hamlyn-Harris) communicated some notes on Kaiva Kuku and Semese dances of Papua, illustrating his remarks with a series of exhibits and lantern slides.

He also showed an interesting example of a clay cap or emblem of mourning from an aboriginal grave at Thylungra Station, S.W. Queensland, weighing 13lbs. 12½ozs. and measuring 14ins. x 8ins. The head dress had been dried in an elongated form and was still in the rough.

Specimens of this kind were worn by either male or female mourners until the clay wasted away with age or it might be removed by remote relatives after a week or so and placed on the grave should the tribe move camp.

Dr. Butler-Wood exhibited some specimens of fossil bones from post-tertiary deposits in the Chinchilla district, including teeth of *Pallimnarchus pollens*, De Vis. & fragment of the mandible of an extinct kangaroo, probably *Macropus cooperi*, and molars of a nototheroid mammal.

A skin of *Hydrus platurus*, L., a widely-distributed sea snake, which was secured at Caloundra and presented to the Queensland Museum, was exhibited by Mr. H. A.

Longman. The specimen was of special interest, being no less than  $45\frac{1}{2}$  inches in length, and considerably longer than any previously recorded specimen.

Mr. C. T. White exhibited the following specimens, all collected in the neighbourhood of Brisbane :

1. Fruits of *Solanum aculeatissimum* with several growths like smaller fruit clustered round the base, these are quite hollow and in most cases attached for the greater part of their length to the ordinary fruit.

2. Photograph of *Musa sp.* (Sugar Banana) in the garden of Mr. Parker, Kangaroo Point, showing an inflorescence growing out laterally from the stem about 3ft. below its normal position ; this condition has been previously noted by H. Newport, in Northern Queensland (Queensland Agric. Jl, 31, p. 186.) Specimens of *Lantana camara* showing basal cohesion of opposite pair of leaves ; this condition is not at all uncommon in *Lantana* and has been previously noted in New South Wales by Fletcher (Proc. Linn. Soc. N.S.W. 39, pp. 89 and 162.)

4. Specimens of *Sonchus oleraceus* and *Emilia sonchifolia* in which a large number of abortive buds on slender stalks were produced in the flower heads in place of the ordinary florets ; floral proliferation in the order Compositae is quite common and has been noted in *Sonchus* in New South Wales by Hamilton (Proc. Linn. Soc. N.S.W. 38, p. 605.)

#### ABSTRACT OF PROCEEDINGS, 26TH JUNE, 1916.

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The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr Hamlyn-Harris, President, in the chair.

The minutes of the previous monthly meeting were read and confirmed.

The president announced that a message of condolence with the relatives of the late Field Marshal Lord Kitchener

had been despatched to the Governor on behalf of the Society, for transmission through the proper channels.

*The following specimens, etc., were exhibited.*—

1. A series of Queensland lichens, by Miss H. Cleminson, M.Sc. (for Dr. Shirley.)
2. (a) An electromagnet, (b) a section of a meteorite showing troilite, widmanstätten figures and flow structure, (c) a collection of models of gem stones, by Dr. H. C. Richards.
3. Specimens of *Peripatus*, by Dr. T. H. Johnston.
4. Hyaline Species of *Daphnia*, by Mr. Colledge.
5. Mr. H. A. Longman exhibited a skin of *Python amethystinus*, Schneid, twenty one feet long (without head), and thirteen inches wide. The markings corresponded with those of var. B in the British Museum Catalogue of Snakes. The reptile was secured near Cairns by Mr. J L Branford, who donated it to the Queensland Museum.

He also exhibited a crab which he and Mr. Douglas Ogilby had identified as *Podophthalmus vigil* (Fabr.) — a species not previously recorded, except as a fossil, from Australian Waters.

6. Mr. A. H. Chisholm exhibited a nest and eggs of *Falcunculus frontatus*, the crested shrike-tit of Eastern Australia, taken from a tree top in N.W. Victoria. The nest is constructed of fine threads of bark hammered off eucalypts, the exterior being bound with filmy substance from cocoons.
7. Mr. A B Walkom exhibited a number of specimens of a Crustacean (probably a macrurous decapod) obtained from the Cretaceous rocks of Woody Island; these probably form a new record for the Eastern Cretaceous of Queensland.
8. Dr. Hamlyn-Harris exhibited photographs of whales stranded at Perkins Islands, Tasmania, (kindly lent by Sir Arthur Morgan); and also examples of pictographic art of the Queensland aboriginal.

ABSTRACT OF PROCEEDINGS, 31ST JULY, 1916.

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The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. Hamlyn-Harris, President, in the chair.

The minutes of the previous monthly meeting were read and confirmed.

The President referred to the loss the Society had suffered in the death of one of the oldest members, Mr. George Watkins, and expressed the members' sympathy with Mrs. Watkins and family. The late Mr. Watkins had been a member since 1884, and since 1905 had acted as honorary auditor. The Hon. A. J. Thynne and Mr. Gurney spoke appreciatively of Mr. Watkins.

The President announced that the Biology Section had been allowed to lapse, on account of an insufficient number of members interested.

At the invitation of the President, Dr. Richards explained the aims and objects of the Commonwealth Bureau of Science and Industry, and intimated that the State Committee for Queensland was anxious that any problems in which scientific research might aid industry, should be brought before their notice.

The subject was discussed by the Hon A. J. Thynne, Dr. Johnston. Messrs. Gurney and Longman, and the President.

*The following paper was read :*

The Endoparasites of the Dingo, *Canis dingo*, Blumb.,  
by T. H. Johnston, M.A., D.Sc.

Remarks were made by Messrs. Gurney and Longman.

ABSTRACT OF PROCEEDINGS, 28th AUGUST, 1916.

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The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. Hamlyn-Harris, President, in the chair.

The minutes of the previous meeting were taken as read.

Mr. H. Tryon and Mr. Lloyd, M.L.A., were proposed as members.

Lecturettes on the subject of the National Park, Lamington Plateau, were delivered by H. C. Richards, D.Sc., and J. Shirley, D.Sc., who illustrated their remarks by a series of lantern slides.

The Hon. Dr. Taylor, and Messrs. Meston, Tryon, and Longman, and the President made remarks.

#### ABSTRACT OF PROCEEDINGS, 25th SEPTEMBER, 1916.

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The Ordinary Monthly Meeting was held in the Geology Lecture Theatre in the University at 8 p.m.

Dr. Hamlyn-Harris, President, in the chair. The minutes of the previous meeting were read and confirmed.

Mr. W. Lloyd, M.L.A., was elected a member.

The library exchanges for the month were laid on the table.

Mr. H. A. Longman exhibited a series of crania, some of which were sectioned, to illustrate distinctive cerebral characteristics of the Dingo (*Canis dingo*) and the Marsupial Wolf (*Thylacinus cynocephalus*). The cranial foramina and their associations were demonstrated by marked flexible rods, and comment was made on their allotment as either salient or variable characters in classification.

Dr. Hamlyn-Harris exhibited three varieties of fire-sticks; (a) the lengthy form described by Roth; (b) a smaller form, the sticks being only about one foot in length, and provided with a wooden human figure, the eyes of which were used in contact with the twirling wands. These two were shown to emphasise the primitive nature of (c) a very valuable set of fire-sticks received from Mr. E. J. Banfield, Dunk Island. These consisted of very rough sticks (possibly one of the "Cotton-trees," *Hibiscus* sp.), just torn down and used then and there, and afterwards thrown away and discarded.

Mr. B. Dunstan exhibited specimens of fossil insects.

Dr. H. C. Richards exhibited a number of fragments of the carapace of a tortoise, and also specimens, probably ostracods, from the Redbank Plains.

Mr. C. T. White exhibited (1) a small collection of plants made by Mr. H. A. Longman, at Currumbip Creek, Southern Queensland, in March, 1916. The more interesting records were :—*Stephania aculeata*, Bail. ; *Elæocarpus kirtoni*, F.v.M., the identification of which with *E. longifolius*, C. Moore (*non*. Blume *nec*. Wallace), and *E. bauerlenii*, Maid. et Bak., has been pointed out by Maiden and Betcher in Proc. Linn. Soc., N.S.W., 23 (1898), 772 and 33 (1908), 305 ; *Marsdenia rostrata*, R.Br. ; *Utricularia pygmaea*, R.Br., flowers pale yellow ; *Glochidion ferdinandi*, Muell. Arg. var., *supra-axillaris*, Benth. (2) Specimens of *Jacksonia scoparia*, R.Br., from Stanthorpe and Brisbane, showing fasciation of the stem prominently developed and specimens of *Westringia eremicola*, A. Cunn., collected near Brisbane, showing cohesion of branches. (3) By permission of the Director, fruiting specimens of *Milletia australis*, Benth. (*M. Maideniana*, Bail.), from plants in Brisbane Botanic Gardens, some of the pods were 8 in. in length and contained seven seeds. (4) Specimens of the stem of *Milletia megasperma*, F.v.M., the outer bark of the stem in this species exfoliates in thin, papery layers giving it a very characteristic appearance.

Dr. Shirley exhibited an interesting case of parasitism from Western Queensland.

#### ABSTRACT OF PROCEEDINGS, 30th OCTOBER, 1916.

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The Ordinary Monthly Meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. Hamlyn-Harris, President. in the chair.

The minutes of the previous meeting were read and confirmed.

The library exchanges for the month were laid on the table.

The meeting then resolved itself into a Special General meeting, to consider the alteration of Rules 21 and 22. Mr. Colledge proposed, and Mr. Gurney seconded, that these rules now read as follows:—

21. TREASURER.—The Treasurer shall collect and receive all moneys on account of the Society, and deposit the same in a Bank approved by the Council; make all payments ordered by the Council on receipt of written authority from the Chairman of the Meeting, such payments being made by cheques signed by himself and countersigned by the Secretary.

At the Annual Meeting following his term of office, the Treasurer shall submit a balance sheet, audited by an Accountant elected at the previous Annual Meeting.

22. SECRETARY.—The Secretary shall attend and take minutes of the proceedings of all meetings of the Society, Council, and Committees thereof respectively; make the necessary arrangements for meetings, issue the required notices, despatch the proceedings of the Society to Members, and generally transact the ordinary routine business.

The alterations were unanimously agreed to.

*The following paper was read:—*

Notes on a few interesting plants collected in the vicinity of Brisbane, by C. T. White

Mr Longman and Mr. Tryon made remarks.

Mr. Chisholm exhibited a number of lantern slides of the yellow-breasted Shrike Robin (*Eopsaltria australis*) and the Satin Bower Bird.

#### ABSTRACT OF PROCEEDINGS, 27TH NOVEMBER, 1916.

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The Ordinary Monthly Meeting was held in the Geology Lecture Theatre, in the University, at 8 p.m.

Mr. E. H. Gurney, Vice-President, in the chair.

The Chairman apologised for the absence of the President, who was unable to attend on account of ill health.

The minutes of the previous meeting were read and confirmed.

The library exchanges for the month were laid on the table.

*The following paper was read :*

Three Undescribed Queensland Fishes, by J. Douglas Ogilby.

The paper was communicated by Mr. H. A. Longman and remarks were made by Dr. Richards and Mr. Gurney.

Mr. C. T. White exhibited adventitious roots of *Eucalyptus robusta*, Sm., obtained by him on Bribie Island. *E. robusta* is a common species in coastal swamps in New South Wales and Southern Queensland. These adventitious roots are common in *Melaleuca linariifolia* and *M. leucadendron*, two species of Paper-barked Tea-trees, but the exhibitor had not met with any previous record of their occurrence in *Eucalyptus*; however, it is probable that most swamp trees with "papery" or "stringy" barks develop these roots.

Mr. H. A. Longman exhibited (1) a remarkable fasciated growth of *Lepidium fasciculatum*, Phellung, from the Darling Downs; this condition has also been noted for *L. ruderale*, a close ally of this common weed, in N.S.W. (Proc. Linn. Soc., N.S.W., 35 (1910), p. 805); (2) a living *Lialis burtoni*, Gray, which had recently swallowed in captivity two specimens of skink lizards (*Lygosoma tenue*)—an interesting sidelight on its habits; (3) a large living specimen of the "Bandy-bandy" snake, *Furina occipitalis*, D. and B., which is a beautiful object when in quick motion.

Mr. A. H. Chisholm exhibited a nest of *Sericornis citreigularis*, the yellow-throated scrub wren, known to the settlers as the "black-nest bird" and "Devil bird." The nest was taken on Nov. 20th from a "lawyer-cane" in thick scrub on the Blackall Ranges. It contained one broken egg. Several nests of *Sericornis magnirostris*, the large-billed scrub wren, constructed with similar artistry, were examined close by.

## Library Exchanges Received. 1st January to 30th November, 1916.

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### AMERICA.

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- Agricultural Research Institute, Pusa: Report, 1914-5.  
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- Australian Museum: Records, 11 (1-5); Miscellaneous Publication, 10.  
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## QUEENSLAND

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## VICTORIA.

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 Commonwealth Bureau of Census and Statistics: Official Yearbook  
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## ITALY.

- Laboratorio di Zoologia Generale di Agraria: Boll., 10.  
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## PORTUGAL.

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- Royal Botanic Gardens: 9 (41).  
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## SPAIN.

- Academia Real de Ciencias, Madrid: Revista, 13 (1-12), 14 (1-11).  
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- Naturforschende Gesellschaft in Zurich: Vierteljahrsschrift, 60 (3, 4), 61 (1, 2).  
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## OCEANIA.

- Bernice Pauahi Bishop Museum, Honolulu: Mem., 4 (1); Occasional Papers, 6 (3).

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